

The Socotra Archipelago at the turn of the Millennium

A faunistic report on the occasion of the centennial anniversary
of the Austrian expedition to South Arabia in 1898/99

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Abstract

The Socotra Archipelago is distinguished by unique geology and a rich variety of plant and animal species, including an exceptional number of endemics and relic species of special biogeographic and developmental interest. The flora and fauna of the islands appear to have been comparatively little affected by modern development. A significant part of available data dates back to expeditions over one hundred years ago, such as the Austrian South Arabia Expedition of 1898/99. This in turn creates several problems for well-prepared nature protection and sustainable development concepts. The paper gives a brief overview on the natural history of the Archipelago with special consideration to the fauna, especially the butterflies and moths.

Zusammenfassung

Der Sokotra Archipel zeichnet sich durch eine einzigartige Geologie und eine Vielfalt an Pflanzen- und Tierarten aus, darunter viele endemische Arten und Reliktarten von besonderem biogeographischen Interesse. Die vorgelegte Untersuchung zeigt, daß Fauna und Flora relativ wenig durch moderne Einflüsse verändert wurden. Viele verwendete Daten gehen auf die großen Expeditionen vor mehr als einhundert Jahren zurück. Erwähnenswert ist die Österreichische Arabien Expedition der Jahre 1898/99. Die auf Sokotra gefundenen Naturschätze bedürfen einer besonders ausgewogenen Naturschutzkonzeption und der Abwägung verträglicher Nutzungsstrategien. Anlässlich der Jahrhundertfeier der österreichischen Arabienexpedition gibt diese Arbeit einen umfassenden Überblick über die Naturgeschichte des Sokotra Archipels mit besonderer Berücksichtigung der Fauna, speziell der Lepidopteren.

Key words: Conservation Projects, Endemism, Ethiopian Region, Fauna, Lepidoptera, Natural History, Nature Protection, Socotra, Yemen, Zoogeography.

Introduction

Due to one of the main intentions of "Quadrifina", to publish papers with historical relevance, this paper is a general contribution to the research on Socotra and part of a certain millenium-project.

„Dioscorida...is very large but desert and marshy, having rivers in it and crocodiles and many snakes and great lizards of which the flesh is eaten and the fat melted and used instead of olive oil. The island yields no fruit, neither vine nor grain. The inhabitants are few and they live on the coast towards the north, which from the side faces the continent. They are foreigners, a mixture of Arabs and Indians and Greeks who have emigrated to carry on trade there. The island produces the true sea-tortoise, and the land-tortoise and the white tortoise, which is very numerous and preferred for its large shells, and the

mountain tortoise... this is part of the oldest documented information on Socotra, then called *Dioscorida*, which appeared in „Periplus of the Erythraean Sea“, a shipping manual written in the first century A.D. by an unknown Greek sailor.

Almost 2000 years later, the Archipelago still ranks among the comparatively unexplored parts of the world. Apart from some 19th century travel accounts the island has been a relatively well-kept secret, virtually isolated from the rest of the world and effectively closed to foreign visitors by military considerations and extreme natural conditions. Especially during the time of the south-west monsoon, i.e. from May to September, when the islands are usually cut off completely, as high winds and dangerous seas make an approach by ships and aeroplanes almost impossible. Even under calm conditions communications from the mainland by air and by boat are severely restricted by the lack of a good harbour, poor airport facilities and inadequate aircraft. Because of this, Socotra remains one of the most inaccessible places on earth, although it is only 240 kilometres away from the Horn of Africa.

The author visited Socotra Island for field work several times between 1982 and 1999, staying there for one to four weeks each time. This included a UNESCO Fact Finding Mission in 1993, whose objective was to consider the establishment of this unique island as a Biosphere Reserve (WRANIK 1993), and a Multidisciplinary Expedition of the Global Environment Facilities funded Socotra Biodiversity Project in 1999.

The paper, which is written on the occasion of the centenary of the Austrian expedition to Socotra in 1898/99, gives a brief overview on the natural history of this unique and exceptional archipelago with special attention to the fauna.

The Socotra Archipelago

The Socotra archipelago is part of the Republic of Yemen and is situated in the north-western part of the Indian Ocean (Fig. 1). It comprises the four islands Socotra, Abd al Kuri, Samha and Darsa. The islands are separated from one another by relatively shallow seas and from the mainland by a deep trench.

Socotra, the largest island, is about 120 by 40 km and covers an area of 3625 km² (Figs. 2-7). It is composed of a basement complex of igneous and metamorphic rocks of Pre-Cambrian age overlain by sedimentary rocks, mainly limestone and sandstone.

Topographically it can be divided into three main zones (Fig. 20):

- the coastal plains, varying considerably in width
- a limestone plateau, averaging 300 to 700 m in altitude, and extending over most of the island. It is dissected by a number of deep valleys and steep escarpments and in places is bounded directly by the sea
- the Haghir mountains in the centre rising up to a height of 1519 m.

Abd al Kuri, the second largest island, lays about midway between Socotra and the African coast with its western tip only about 100 km off the coast of Somalia. It stretches about 36 km from east to west and is less than 6 km wide. Most of its surface is occupied by chains of low hills, and the highest point is only about 800 m. There is no surface water but there are a few brackish wells (Figs. 8-9).

The islands of Samha (about 770 m) and Darsa (about 350 m), also called „The Brothers“, are both flat topped limestone plateaus with sheer sides. Samha has a sufficient freshwater supply and is inhabited by a small human population, while Darsa is uninhabited but sustains a large rat population (Figs. 10-11).

On all these smaller islands the conditions are more extreme than on Socotra. Large parts are fairly barren-looking. The vegetation is dominated by low woody-herb communities with woodland absent, and shrubland restricted to a few, sheltered places.

The climatic conditions of the archipelago arise from its position with regard to the seasonal monsoons of the Indian Ocean, which involve the alternate dominance of two opposing major wind systems (Fig. 7). The reversal of wind direction at the change of season is so marked that it is usually accompanied by a reversal of ocean currents in the north-western basin of the Indian Ocean. There are no exact figures available on the annual temperatures and rainfall.

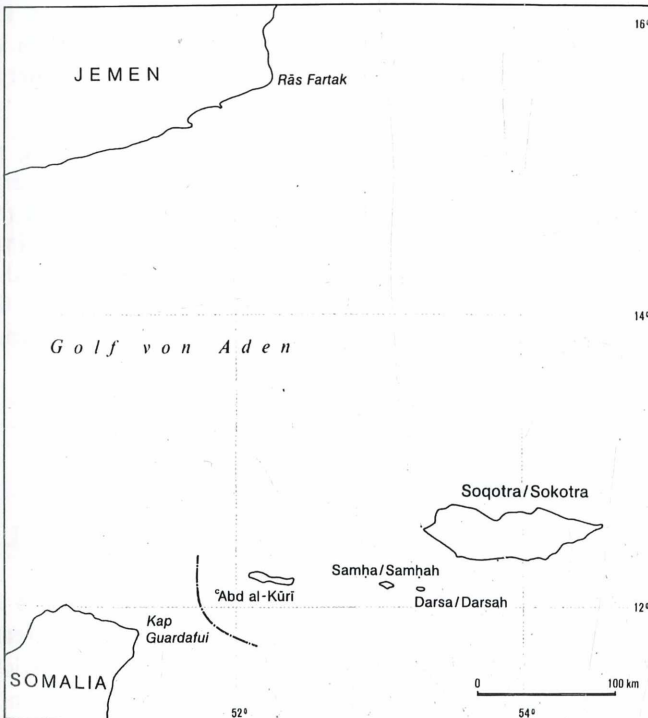
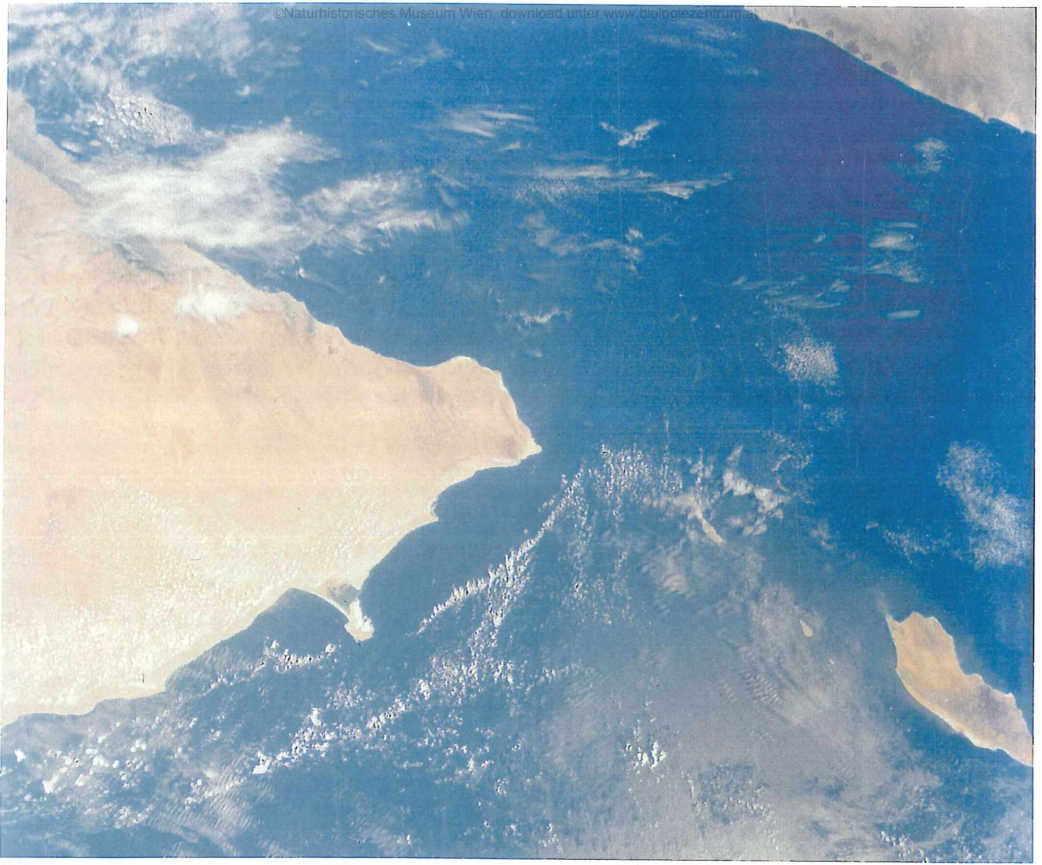


Fig. 1 The Socotra Archipelago:

Above: The area, as seen from an US Satellite (Reproduced by kind permission of U.S. National Aeronautics and Space Administration).

Below: Sketch map showing position of the Socotra Archipelago.

The Socotra Archipelago is an eastern continuation of the Somali Peninsula and lies along the East-West Rift of the Gulf of Aden, geographically and geologically it is part of Africa.

As far as known the mean annual temperature varies between 28-37°C and the mean annual rainfall varies between 130-170 mm per year, but is probably much greater in the central highlands. Socotra gets its main rains during the winter monsoon, while the summer monsoon winds are rather dry and stormy. The mountains are frequently shrouded in clouds and heavy mists and dew are common (hence also Socotra's ancient name „Isle of Mists"), which seem to be a main water source for vegetation in the higher altitudes. Mists and dew also supply the water requirements for a number of animals.

The Haghier massif has higher rainfall, it forms the most important watershed on the island and numerous watercourses run both north and south from it. There are also permanent springs there. Particularly on the northern slopes these streams are permanent in their upper reaches, but on the plains they are mostly sporadic, carrying water only during the rains and just after. However some of the river estuaries retain water for most of the year. Although not well known, there seems to be a relatively large underground karstic system and also undersea fresh water springs are reported.

Evolutionary History and Biogeography

From a natural history viewpoint Socotra remains one of the most fascinating places in the world. This unique character is related to its geological history. Originally part of the African-Arabian tectonic plate, the island is probably part of a fault block separated off from the African mainland by the same series of dislocations which produced the Gulf of Aden in Tertiary times. KOSSMAT (1907) characterized Socotra as one of the „most isolated pieces of land“ in the history of the earth. As GREGORY (1903) quoted T. G. Bonney: „.....the topmost peaks of the Haghier Mountains were at no time wholly submerged....in the Haghier Hills, we have probably a fragment of a continental area of great antiquity and of a land surface which may have been an 'arc of refuge' to a terrestrial fauna and flora from one of the very earliest periods in the world's history“.

The high degree of endemism, as a result of this long isolation, makes the archipelago a „living laboratory“ of remarkable biogeographic and evolutionary interest and an important place in terms of global wildlife conservation.

Although the geological history of the Archipelago is in many details still imperfectly known, it is possible to suggest that some of the endemic species are relics and descendants of an ancient flora and fauna surviving in the Socotra Haghier massif, which is considered by geologists not to have submerged since the Mesozoic (UVAROV & POPOV 1957).

Socotra is positioned near the junction of three of the world's major biogeographical regions, the Ethiopian or Afrotropical, the Oriental and the Palaearctic Region (Fig. 12). In biogeographical terms terrestrial Socotra is in general more closely linked with the adjacent parts of Somalia and Arabia (the Ethiopian Region), but is also linked with the Eremic Zone, i.e. the arid belt separating the three main biogeographical regions. Furthermore there are interesting affinities and links with other areas, including some remote islands of the Atlantic Ocean. An explanation for such disjunct distribution could be, that these related island species represent relics of originally widespread populations, which became extinguished on the mainland by more recent developments.

Fig. 2 Socotra Island (next page / nächste Seite):

Above: Sketch map of Socotra Island (source: KOPP, in WRANIK 1999).

Below: Socotra Island, as seen from the US Satellite Gemini VII (Reproduced by kind permission of U.S. National Aeronautics and Space Administration).

The backbone of the island is formed by the igneous Haghier mountains which entirely dominates the central and eastern part of Socotra, towering above the surrounding limestone plateau. Along the greater part of the south coast extends a gravel- and alluvium covered plain from up to five kilometres in width, while the coastal plain in the north, backed by the dip slopes of the plateau edge limestones, is much more irregular, less barren and interrupted in the east by a number of headlands.

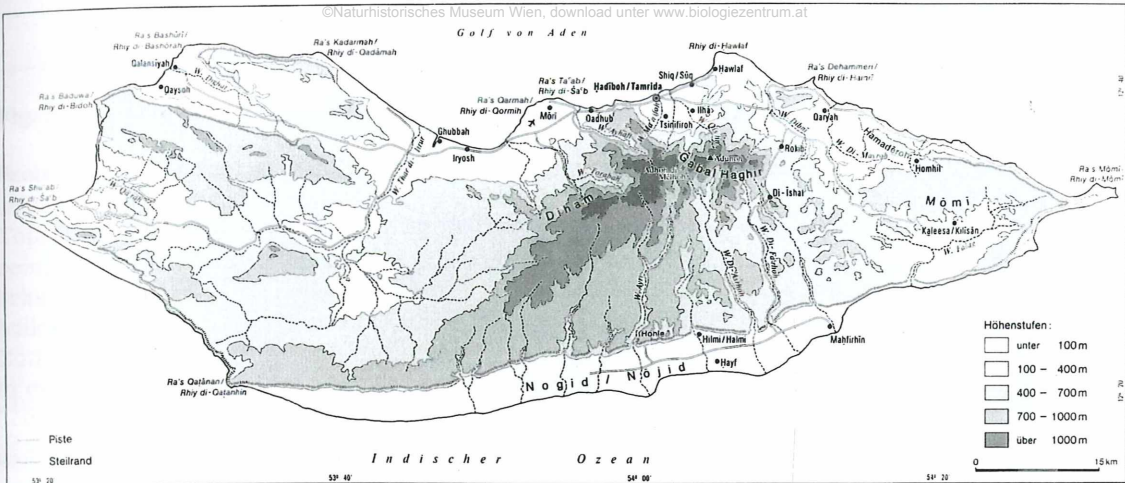




Fig. 3 Socotra Island (previous page / vorige Seite):

People have inhabited the islands for over 2 000 years, however only few details are known on the early history of colonisation.

Top: The figure shows the Bay of Hadibo as seen by the Portuguese in 1541 (Reproduced by kind permission of the British Library, Department of Manuscripts), with the plain and the Haghier mountains behind. Clearly shown on the left are a church at Suq and a fort on the beach guarding the inlet, and buildings on the right depict Hadibo with palms which border Wadi Manifoh.

Bottom: The Socotran skyline is dominated by the rugged pinnacles of the Haghier mountains, which rise to over 1500 metres and are usually blanketed in cloud. In the foreground are some of the squat stone houses of the main settlement Hadibo.

There is probably a more frequent exchange of populations of mobile life forms, such as bats, birds, grasshoppers and other insects, between the islands and the adjoining mainland. However the absence of many widespread mainland species on Socotra seems to point to other barriers existing for the passive colonisation by wind, water and trade.

Further taxonomic studies are needed to clarify the status of the endemic species and their way of speciation, and there also remains a great need for further studies of the ecology of the individual species and their main habitats on the islands.

The taxonomic and biogeographical interpretation of the existing data is complicated by the insufficient knowledge of the fauna of the surrounding African and Arabian mainland. Therefore at present any numbers on the percentage of endemics remain tentative. It may be, similar to the situation of plants, that a number of Socotra animal species will lose their endemic status once better faunistic knowledge on both, the archipelago and the mainland is available. However this will not reduce Socotra's intriguing biogeographical position.

The situation in the sea is also interesting. The archipelago could be biogeographically an area of major overlap between the Arabian and Indian Ocean marine faunas, with endemics from both regions represented (Fig. 13). First investigations on shallow water fish communities and decapod crustaceans (TÜRKAY et al. 1996) not only gave a picture of mingling different regional fauna, but also indications of distinct and well-established communities (Fig. 108).

Even if Socotra can not be considered as an untouched area, as a result of the long isolation and the traditional rules, it is relatively little affected by modern development in comparison with other island ecosystems. Until now, with exception of some areas in the more exploited coastal plains, the whole island has been dominated by a traditional balance between man and the environment. Therefore Socotra is suggested as one of the best preserved semi-arid tropical islands in the world (WCMC 1993).

Fig. 4 Socotra Island (next page / nächste Seite):

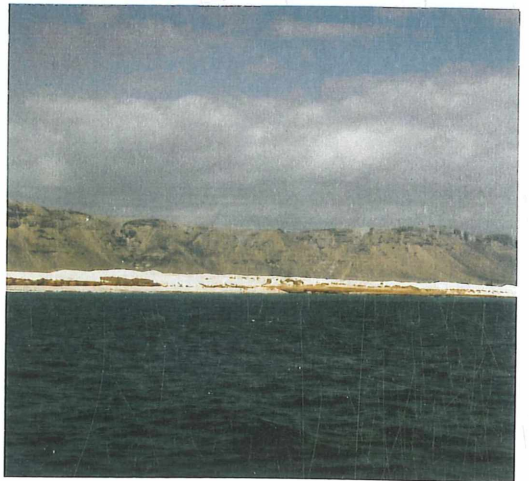
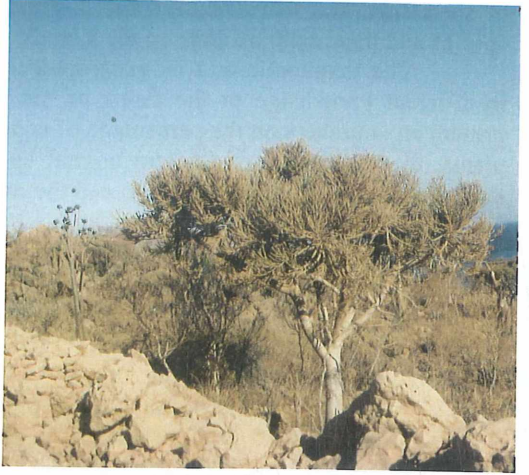
The coastal plains vary considerably in width, in general they are sparsely vegetated and dominated by xeromorphic forms. The main coastal habitats are rocky cliffs, rock cobble and sand beaches.

Top: View to Ras Hawlaf where sand has become banked against the limestone to a height of about 100m.

Middle: Coastal area Ras Hebak west of Hadibo in September. The vegetation is disappointingly dry.

Bottom left: Estuary near Qadhub with Date palm trees.

Bottom right: View to the Noked plain on the south coast of Socotra, with about 60 km the largest unbroken stretch. It is terminated northwards by a precipitous escarpment averaging about 400 m in elevation.



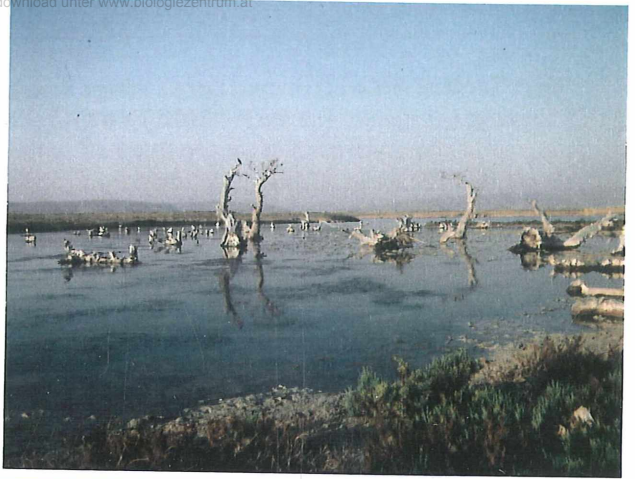


Fig. 5 Socotra Island (previous page / vorige Seite):

Mangrove (*Avicennia marina* (FORSSK.) VIERH.) occur as small local belts and patches along inlets on the south-west coast and parts of the western half of the north coast with tall trees, standing up to a height of almost 8 to 10 metres. However in comparison to the zones marked as mangrove on older maps a greater number of areas seems to be already destroyed.

Top left: Mangrove (*Avicennia marina*) near Gubbah in 1967.

Top right: The same area in 1999. A few bare trunks are all that remain of this once well developed mangrove.

Middle: View to *Avicennia marina* mangroves near Ra's Shoab.

Bottom: The mangrove near Ra's Shoab.

The history of biological exploration

A significant part of the available data on the natural history of Socotra dates back to 1880-90ths expeditions.

Before then in 1834 Lt. J.R. Wellsted (1805-1842) undertook a survey of Socotra for the Indian Government with the East India Company's survey ship "Palinurus". He made a detailed account of the island, collected some plants, and made notes on the fauna and flora, such as the dragon's blood tree and the traditional methods of collecting the Socotran aloes. In later years the island was briefly visited by some botanists (L.-H. Boivin 1847, Wykeham Perry 1876 and Dr J. Collins 1877), who all collected various plant specimens.

After news of Socotra's rich flora had reached the British Association for the advancement of Science it put aside £100 for „taking steps for the investigation of the Natural History of Socotra" and launched a first scientific expedition led by Prof. Isaac Bayley Balfour (1853-1922) in 1880 (Fig. 14). He was accompanied by Lt. C.J. Cockburn of the British army and Alexander Scott, a gardener of the Royal Botanic Garden, Edinburgh. The team reached Socotra on 11th February 1880 and spent 48 days on the island making zoological, geological and above all botanical collections. The latter resulted in a first detailed botanical account of the island with a description and illustration of over 200 species and 20 genera new to science in Balfour's „Botany of Soqotra" (1888). An account of the recorded animals was given in 1881 by BLANFORD, BUTLER, GODWIN-AUSTEN, GÜNTHER, SCLATER & HARTLAUB and WATERHOUSE.

Balfour's visit was followed one year later by an expedition of two German naturalists. Dr. Georg August Schweinfurth (1836-1925) and Dr. Emil Riebeck (1853-1885), who spent six weeks on Socotra in April/May 1881 (Fig. 15). Beside studying the people and their language, they investigated also the flora and fauna of the island. The plants collected were included by Balfour in his Botany of Socotra and the faunistic data were published by MARTENS 1881, HARTLAUB 1881, PETERS 1882 and TASCHENBERG 1883.

Dr. Theodore Bent (1852-1897) and his wife Mabel, both archaeologists, made a collection of plants whilst studying the archaeology of Socotra for two months in 1896/97 (Fig. 14). They were accompanied by E. N. Bennett, who scaled some of the mountain peaks for the first time and collected a greater number of animals, mainly arthropods (DIXEY et al. 1898).

The first specific and more complex zoological survey was led by W.R. Ogilvie-Grant (1863-1924) from the British Museum London and H.O. Forbes (1851-1932) from Liverpool Museum (Fig. 14). They reached the archipelago on 3rd December, 1898 and spent about three months there. They also visited Abd al Kuri. Their records were summarized by FORBES (1903) in his famous monograph „The Natural History of Soqotra and Abd al Kuri“.

On behalf of the Vienna Academy of Sciences an Austrian expedition went to South Arabia in autumn 1898. Via Suez the team reached the Yemen port of Aden on 14th November and went on the Swedish steamer „Gottfried“. The main aim of the expedition, which was led by the Swedish Earl Dr. C. Landberg, was to work a way to Shabwa, the „heart“ of Hadramaut. But this plan failed, and the mishap was accompanied by a violent quarrel within the expedition team.

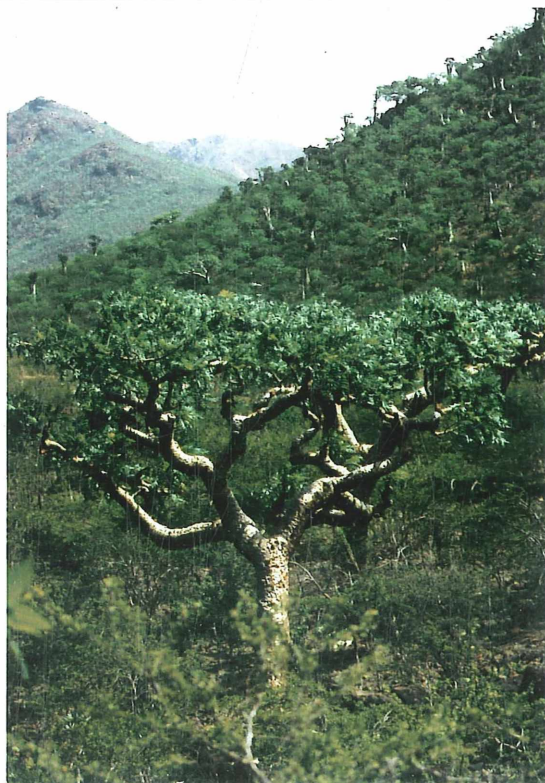
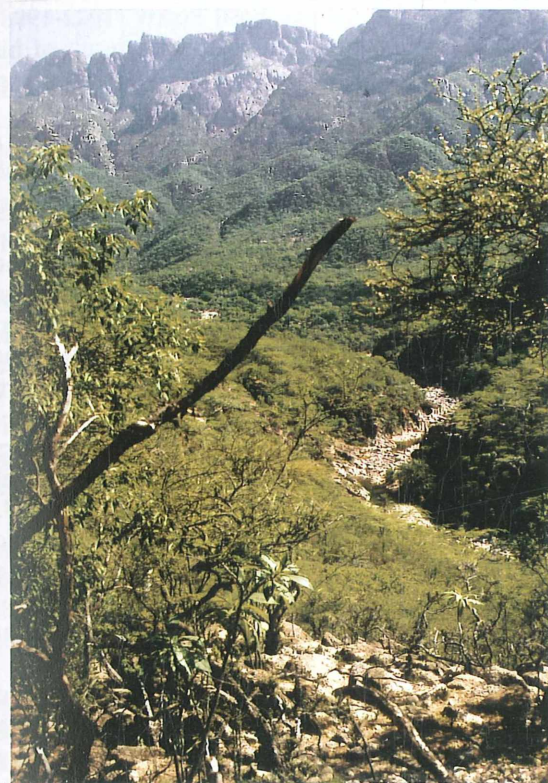


Fig. 6 Socotra Island:

The limestone plateau forms the greatest area of the island. It varies in height between 300 and 700 m and is characterized by open deciduous shrubland, which is dominated by *Croton socotranus*, *Jatropha uncostata* and various succulent and emergent trees (*Dendrosicyos*, *Adenium*, *Euphorbia*, *Sterculia*, *Boswellia*, *Commiphora*). In sheltered valleys and mountain areas, the vegetation is more luxuriant. The higher parts of the Haghier are covered by a mosaic of dense thicket, woody herbs, grassland and lichens.

The conflict finished with the discharge of Landberg as team leader. He was replaced in this position by the Austrian linguist Prof. David Heinrich Müller (1846-1912), and it was decided to divide the group. The Briton G.W. Bury tried again to get into the interior to the Hadramaut, which he finally managed, while the others left for the Socotra archipelago, which was assigned in the expedition concept as a secondary aim. Beside Prof. Müller the team included Dr. Stefan Paulay (1839-1913), the ship's surgeon with special interest in Botany, the geologist Dr. F. Kossmat (1871-1938), Prof. Oskar Simony (1852-1915) a Professor of Mathematics and enthusiastic Entomologist, and Dr. A. Jahn, another linguist (Fig. 16). But they were not the first Austrians setting foot on this island. In February 1858 Wilhelm von Tegetthoff (1827-1871) spent about two weeks there. Though he did not visit for any scientific purpose, rather this was a secret political mission. In this time the Suez Canal was under construction, and Austria was in search of a suitable base in this region. Socotra was on the top of the inspected localities, but Tegetthoff's talks with the sultan ended without any concrete result.

The five scientists landed at the West coast of Socotra, near Ghubbet Shoab, on the 8th January 1899. For about two months they worked mainly on Socotra, but visited also Samha and Abd al Kuri, with important results in various fields. Müller and Jahn gained extensive linguistic studies, such as the collection and translation of Socotran texts. Kossmat put together complex and basic geological data (Fig. 17), while Paulay and Simony saved an extensive collection of plants and animals. Among the recorded animals brought to Vienna were about 4000 insects (of about 500 species), and about 400 reptiles and fishes of 70 species. The geological and biological results were published in a special volume (vol. 71 I & II) of the "Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften" (STEINDACHNER 1903, KOHL 1907, KRAUSS 1907, VIERHAPPER 1907, BECKER 1931, REBEL 1931¹).

After these major activities it was over half of a century until Socotra was again subject of a biological survey. It was carried out by the British entomologist Dr. George Basil Popov (1922-1998) who undertook a study on locusts for the Desert Locust Survey Nairobi (Fig. 18). As a result of his ecological investigations he published an excellent view on the Saltatoria fauna of Socotra, and a first systematic description of its vegetation (POPOV 1957, UVAROV & POPOV 1957, POPOV 1959).

The University of Oxford Expedition of 1956, led by Douglas Botting (b. 1934), aimed to carry a general scientific reconnaissance (BOTTING 1958) (Fig. 18). In the party of six men was the British tropical ecologist Dr. Michael Gwynne (born 1932) who made biological collections and produced a first vegetation map of Socotra (GWYNNE 1968).

There were occasionally small biological collections by members of the British Army who visited the island during the next few years, but most important in this period was the Middle East Command Expedition in spring 1967 (DOE 1992). The collection of plants were made by the two Botanists Alan Radcliffe-Smith (born 1938) from the Royal Botanic Garden Kew and John Lavranos (born 1926), while the zoological records were done by the British entomologist Kenneth Guichard (born 1914) (Fig. 18).

After the withdrawal of the British from Yemen in 1967 Socotra remained for a number of years virtually closed to foreigners and further scientific exploration. Even Thor Heyerdahl and his international crew received no permission to land during their adventurous voyage with the reed boat „Tigris“, in 1977.

In 1982 the geographical and biological departments of the University of Aden sent a scientific mission to Socotra, which can be considered as the start of Yemens national research activities on the island (WRANIK et al. 1986) (Fig. 19).

In 1985 the British botanist Quentin Cronk made a short visit to the island and concluded, that the vegetation had changed little, if at all, since the major expeditions a hundred years ago.

In the 1990s several missions were fielded with the participation of UNESCO, FAO and specialized national and international environmental, ecological and natural resources groups, such as the Royal Botanic Garden Edinburgh (ALEXANDER & MILLER 1996), BirdLife International (OSME Survey 1993; PORTER et al. 1996), Aden University and the Yemen Ministry of Agriculture, or Rostock University in cooperation with the Museum für Tierkunde Dresden (WRANIK 1998) (Fig. 19).

These activities have brought a wealth of information documenting different aspects of the islands environment. The floristic surveys already allow a detailed description of the flora and vegetation of Socotra (Fig. 20).

¹ The "Halbband II" of "Band 71" was published 1931, but the included papers had been delivered much earlier to the Academy

In comparison little is known about the ecology, distribution and population size of the majority of animal species, so that the existing data are insufficient to develop a comprehensive assessment of the island's fauna. This, in turn, creates severe problems for a well-prepared protection strategy. Undoubtedly, there is still a definite need for further field surveys.

Flora and vegetation

Since the first botanical expeditions about one hundred years ago Socotra has been famed for its botanical curiosities, but in this paper only a very short view on this fascinating aspect of the archipelago can be given (Figs. 20-30).

Altogether some 850 plant species have been recorded, about 270 of which are considered to be endemic (ALEXANDER & MILLER 1996). Among them there are strange-looking remnants of ancient floras, which disappeared from the surrounding African-Arabian mainland long ago. According to the World Conservation Monitoring Centre the archipelago is the world's tenth richest island group in terms of endemic plant species.

In general the islands of the archipelago are sparsely vegetated and dominated by xeromorphic forms, which are well-adapted to the harsh climate, such as the desiccating winds of the summer period. Only in sheltered valleys and higher mountain areas the vegetation is more luxuriant (MIES 1993 & 1995, DAVIS et al. 1994, ALEXANDER & MILLER 1996). In general the floristic richness increases with altitude.

Of particular interest are the tree succulents *Dendrosicyos socotranus* BALF.f., *Adenium sokotranum* VIERH. and *Euphorbia arbuscula* BALF.f. which have a bizarre appearance, and are typical at the shrubland on the foothills and the limestone escarpments of Socotra (Figs. 21-22, 25).

The members of the family Cucurbitaceae consist mostly of climbing plants, but in *Dendrosicyos socotranus* they are represented by an elephantine tree growing up to seven metres (Fig. 21). Gigantism, is a curious phenomenon of island evolution that may evolve over time in the absence of tall grazing herbivores. Also the Desert Rose (*Adenium sokotranum*) is characterized by a grotesquely swollen trunk, which keeps the tree supplied with water during the summer droughts (Fig. 22).

Perhaps the most famous botanical curiosity of Socotra is the dragon's blood tree *Dracaena cinnabari* BALF.f., characterized by a mushroom-shaped silhouette (Figs. 23-24). Related species are found in quite disjunct areas, such as north-east Africa and the Canary Islands. They are all relicts of an older flora from the Tertiary period, that once inhabited the existing islands between today's Madeira far to the East. Unlike its relatives, which have become very rare in many places, this xerophytic tree is still widespread on Socotra and dominates the evergreen woodland in the centre and east of the island. In legend the tree sprung up from congealed blood shed by a dragon and an elephant as they fought to the death. The red resin from the tree is called *cinnabar* and was a highly prized product in the ancient world. It is still an important resource for the local people, although it has no longer a great commercial value on the international market. It is used to cure stomach problems, dye wool, glue and decorate pottery and houses, or even as lipstick. Most trees look healthy, although rather old, and like other species on the island, such as *D. socotranus*, only very few seedlings or young trees can be found, as a consequence of the grazing pressure of livestock.

Incense was another natural product for which Socotra was famous in the past. There are perhaps eight species of Frankincense trees (*Boswellia*) on the island (Fig. 25), some still to be described. In recent times this resin has only played a minor role in export, but on the island it is still used for its pleasant smell, for curative properties or as a chewing gum, partly to freshen the breath. In ancient times very highly regarded were the Socotran aloes for medical purpose (Fig. 30). There are three species, all endemic and related. Their bitter, ambercoloured juice is still collected by cutting the leaves at the base and leaving the cut ends to drain onto a goat skin for several hours. Among the forms which are of importance as a potential genetic resource is *Punica protopunica* BALF.f., which is considered as the „primitive stock" of the pomegranate *P. granatum*. Of horticultural interest are *Begonia socotrana* HOOK.f., the hybrid parent of winter-flowering begonias, or *Exacum affine* BALF.f., the Persian violet (ALEXANDER & MILLER 1996) (Fig. 27)

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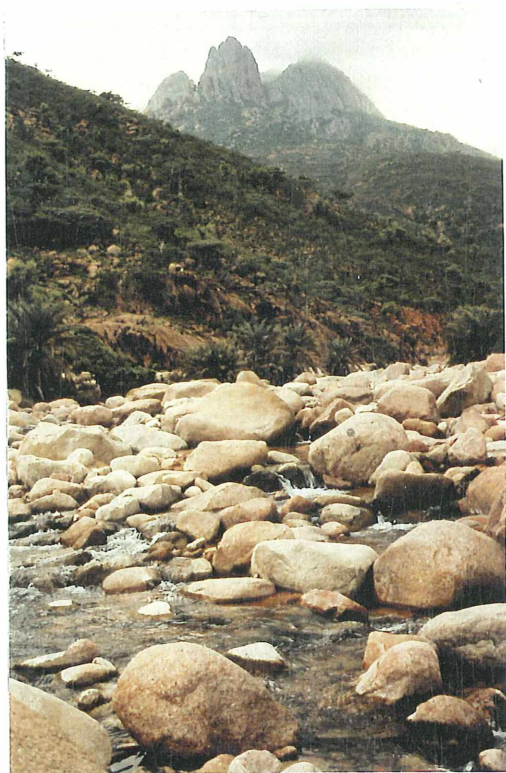
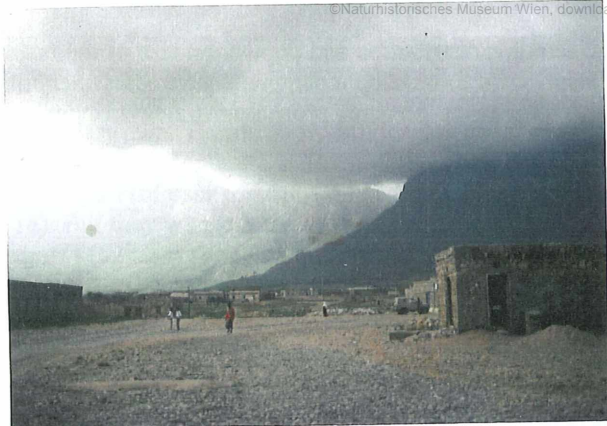


Fig. 7 Socotra Island (previous page /vorige Seite):

Socotra is characterized by a tropical semi-arid climate, where rainfall is scarce. The southwest monsoon blows from late May to early October. It is violent and rather dry, e.g. brings little, if any rain. The northeast monsoon sets in early in November. It is much more gentle, cooler and carries considerable moisture, making the main „rainy season“. However no long term climatic records are available. The only reliable rainfall figures are those measured at a Royal Airforce Station at Ras Karma in the north of the island (1943-45). The data show an annual rainfall for that particular area from 125-175 mm during the three years that records were kept, with the highest precipitation in November/December.

Rainfall records for Ras Karma (mm)

	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1943	tr.	0.1	tr.	tr.	tr.	Nil	Nil	tr.	3.2	3.8	89.6	75.2
1944	4.8	2.1	31.4	tr.	Nil	Nil	0.06	Nil	Nil	4.1	60.2	76.6
1945	3.6	3.5	Nil	Nil	4.3	91.0	tr.	Nil	4.0	21.3	5.5	-

These figures are probably typical for most of the plateau and plain areas, the highlands, however, should have a greater annual rainfall which might be in the order of 380-500 mm. The southern half of the island is probably somewhat drier than the north.

Top left: Heavy clouds hang over the pinnacles of the Haghier throughout the year, particularly during the period of the north-east monsoon. Rain together with heavy mists and dew seems to be more common in these higher altitudes and they bring much-needed moisture to the organisms living there.

Middle: Water courses in the mountains. Most of these streams become dry particularly during the south-west monsoon (**right**), but there are a number of pools and springs which last into the dry season. It is very likely that these limestone areas provide a sizeable groundwater potential in many parts of the island.

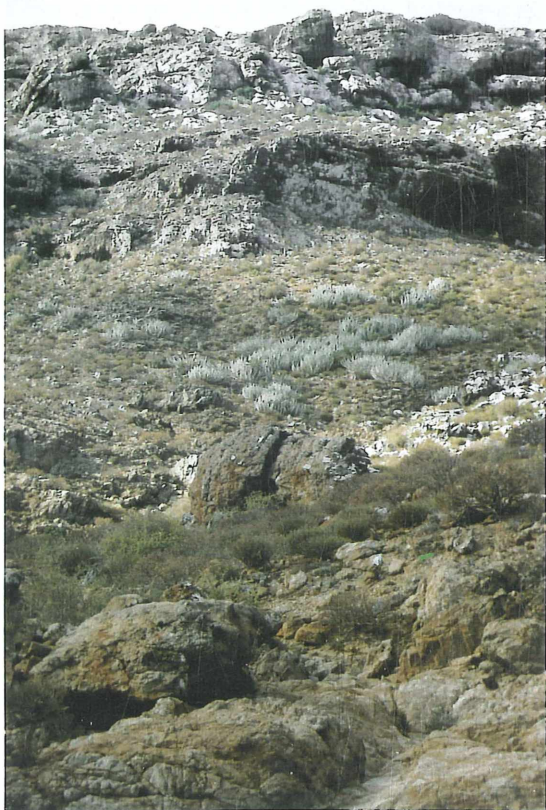
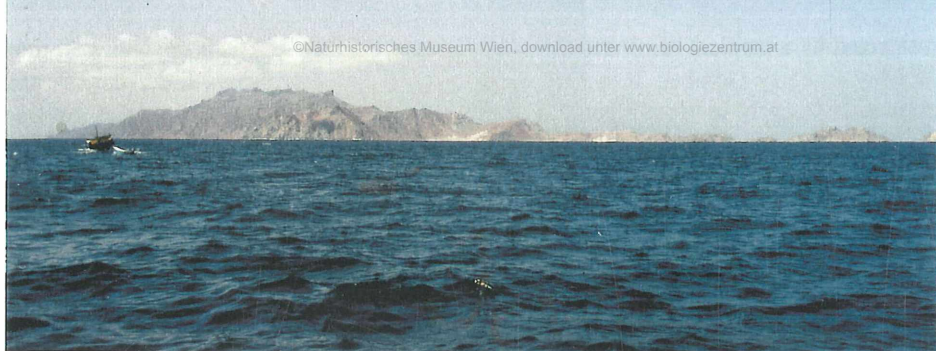
Bottom left: Stagnant water pool at the Diksam plateau, which serves as a water resource for both people and livestock.

Fig. 8 Abd al Kuri (next page / nächste Seite):

Top: View to the eastern part of Abd al Kuri.

Middle: View to the highest hill Jabal Hassala or Jabal Saleh (about 800 m) from the sea.

Bottom: Northern slope of Jabal Hassala. *Euphorbia abdelkuri* BALF.f., the most bizarre endemic plant on Abd al Kuri, is standing like green candles. The vegetation on Abd al Kuri and Samha is poor in species as compared with Socotra.



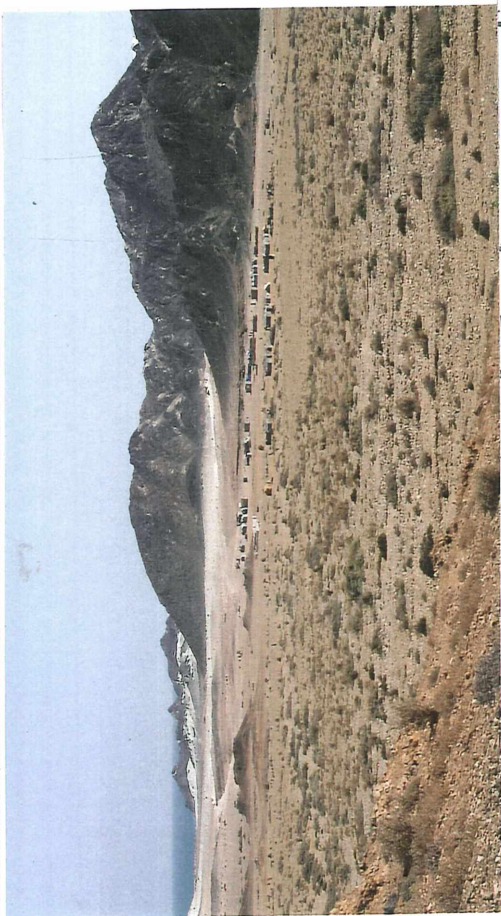




Fig. 9 Abd al Kuri (vorige Seite / previous page):

Top: Geological map of Abd al Kuri (source: KOPP in WRANIK 1999).

Middle: View to Helsat Saleh. The population of this second largest island is estimated about 200 to 300. They engage mostly in fishing and trade.

Middle right: Trading dhow.

Bottom left: One of the few wells on the island, which all have only brackish water.

Bottom right: Young man on Abd al Kuri.

Fig. 10 Samha and Darsa (next page / nächste Seite):

Top left: View to Samha.

Top right: View from Samha to Darsa.

Middle and bottom: Geological map of Samha (source: KOPP in WRANIK 1999) and view to the Samha limestone plateau, which rises up to about 770 m.

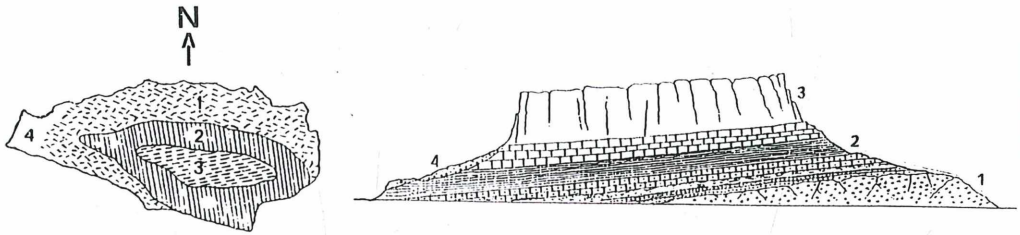
Fig. 11 Samha (page 90 / Seite 90):

Top & middle: Village on Samha. The population of Samha is estimated about 50. They engage in fishery. Darsa is uninhabited.

Bottom: There are some, but limited freshwater sources on Samha. One is water streaming from a coastal rock.



Samha (nach KOSSMAT 1907)



Aufsicht und von Osten gesehen

1. Krystallinische Gesteine

2. Kreide

3. Eocän

4. Schutt





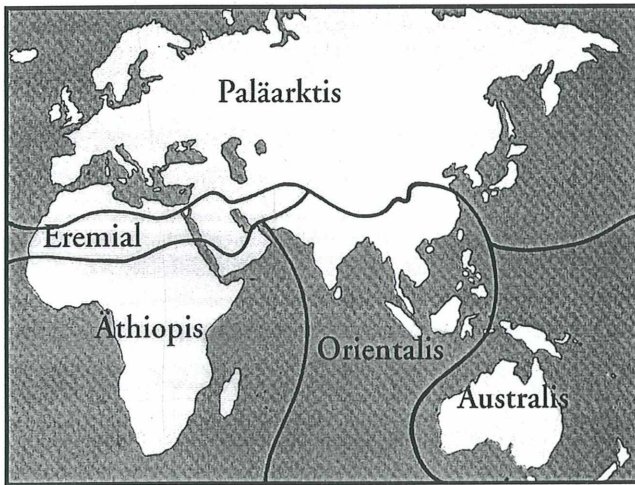
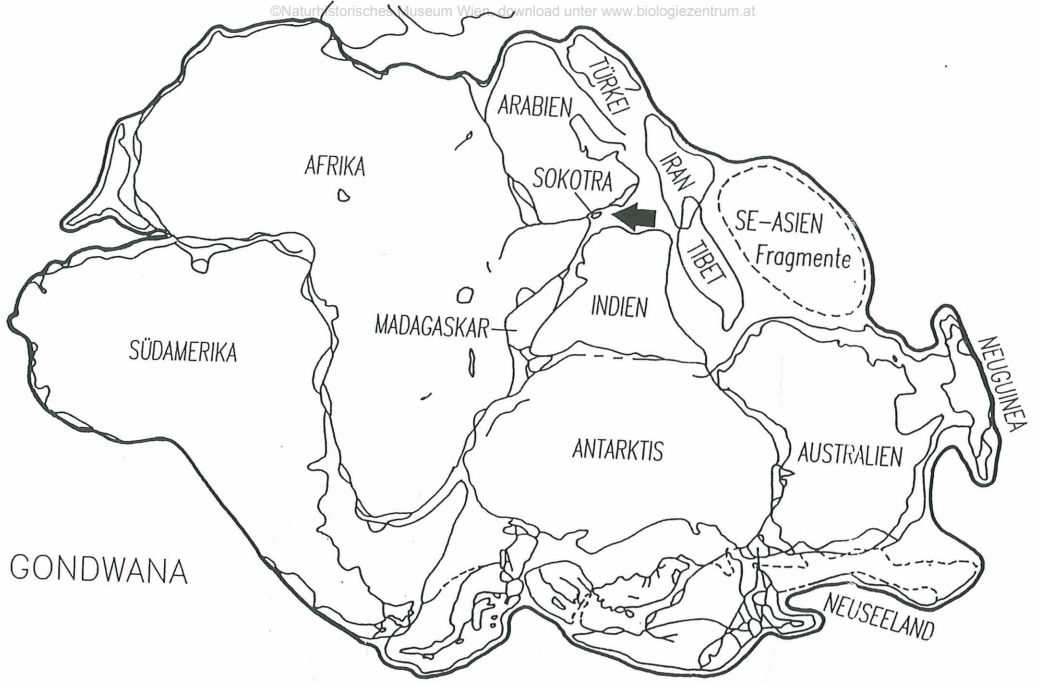


Fig. 12 Biogeography:

Top: Schematic map of Gondwanaland in the early Mesozoic before fragmentation; with the position of Socotra (source: MIES in WRANIK 1999).

Bottom: Biogeographical regions. The Archipelago is situated near the crossroads of three major biogeographical regions. However, at present it is only possible to draw tentative lines delineating the Palaeartic, Ethiopian and Oriental region.

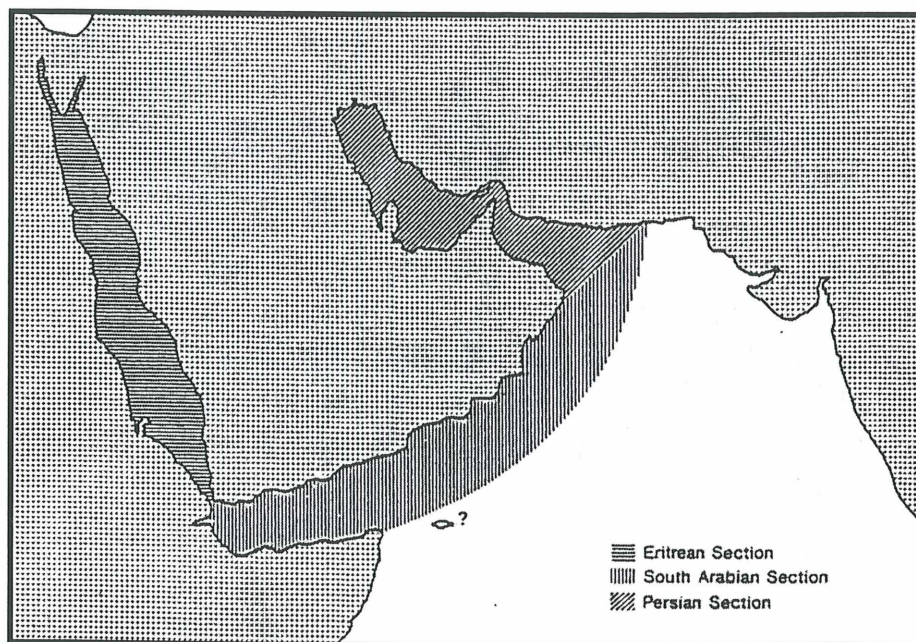
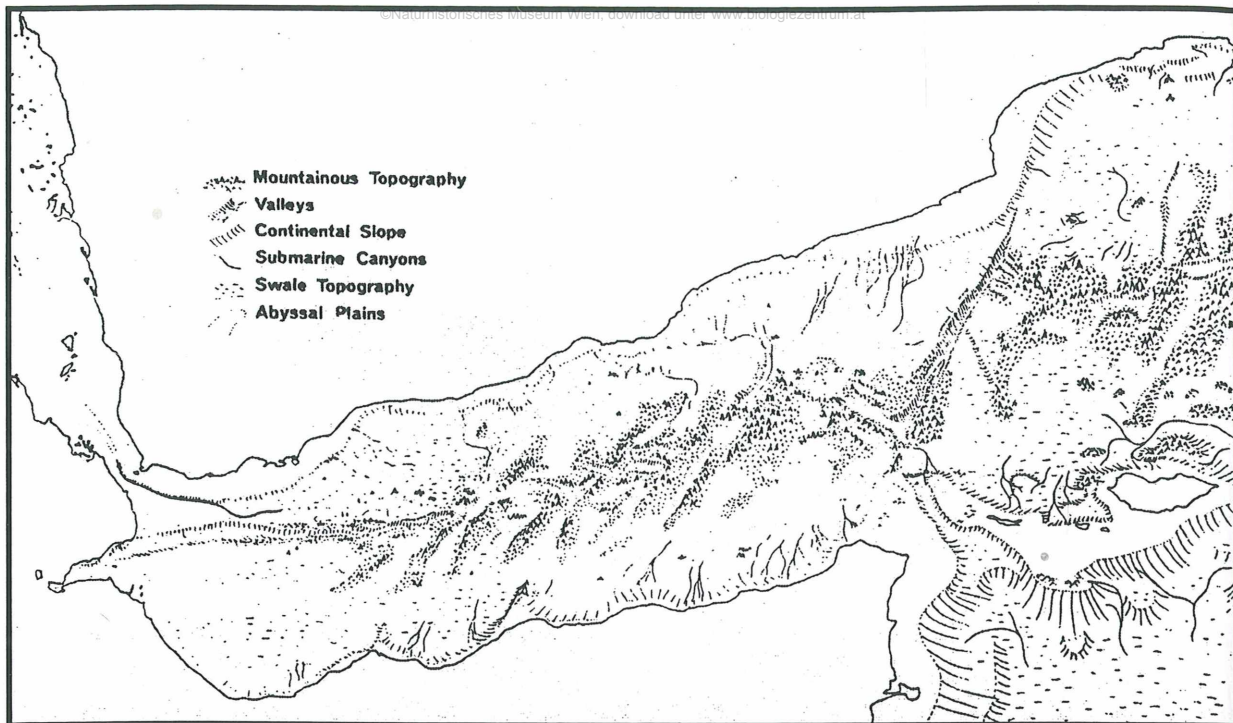


Fig. 13 Biogeography:

The Gulf of Aden and its regional zoogeographic subdivisions, based on littoral fishes of the northwestern Indian Ocean (LAUGHTON 1970, KLAUSEWITZ 1989).

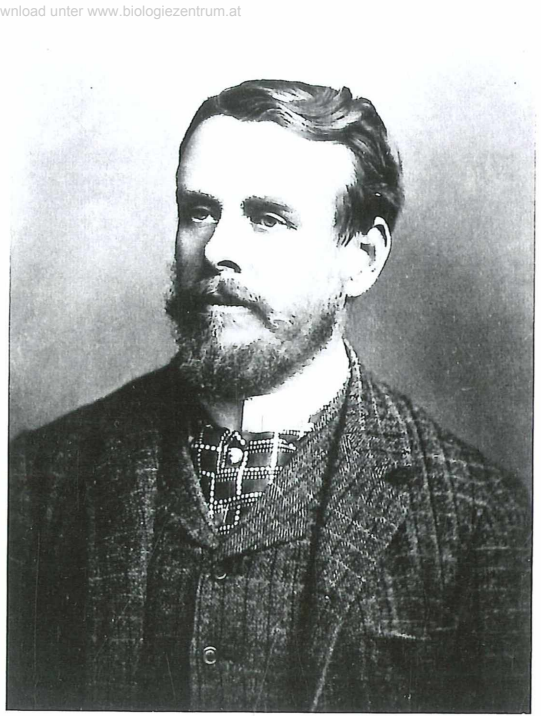


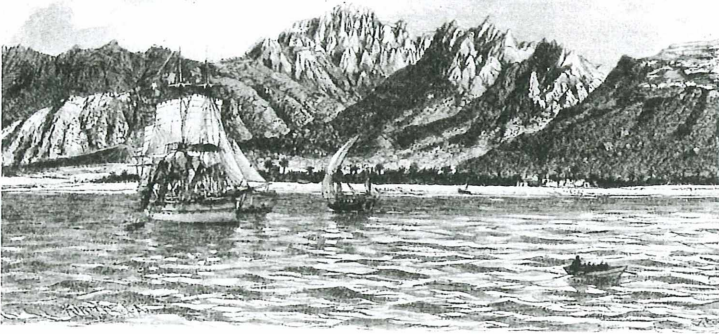
Fig. 14 Socotra Explorers:

Top left: Isaac Bayley Balfour (1853-1922).

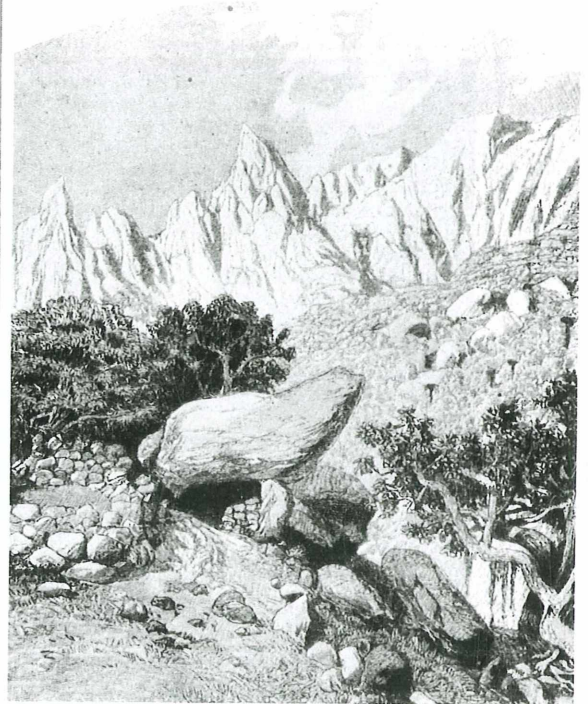
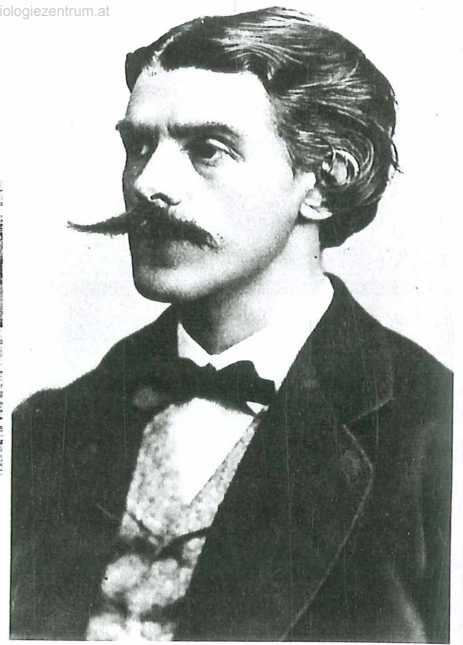
Top right: James Theodore Bent (1852-1897).

Bottom left: Henry Ogg Forbes (1851-1932).

Bottom right: W. R. Ogilvie-Grant (1863-1924).



Tamarid oder Hadibu. Hauptort auf Sokotra



Hirtenhöhle oberhalb Wadi Kischen

Fig. 15 Socotra Explorers:

Top left: The Bay of Hadibo (SCHWEINFURTH 1925).

Top right: Georg August Schweinfurth (1836-1925).

Bottom left: Emil Riebeck (1853-1885).

Bottom right: A dwelling in the mountains (SCHWEINFURTH 1925).

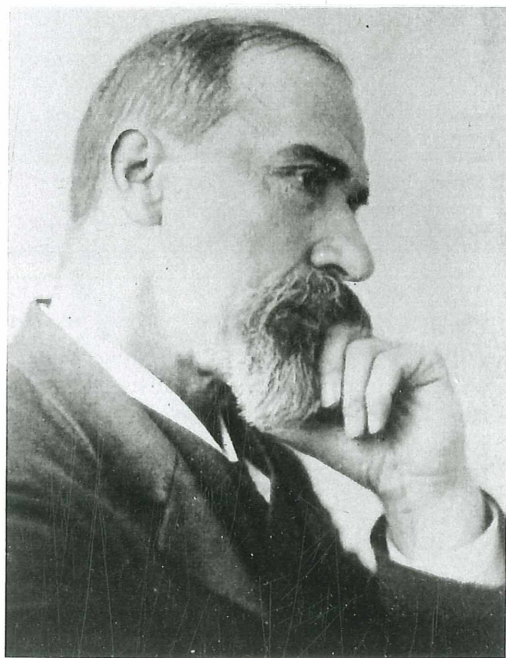
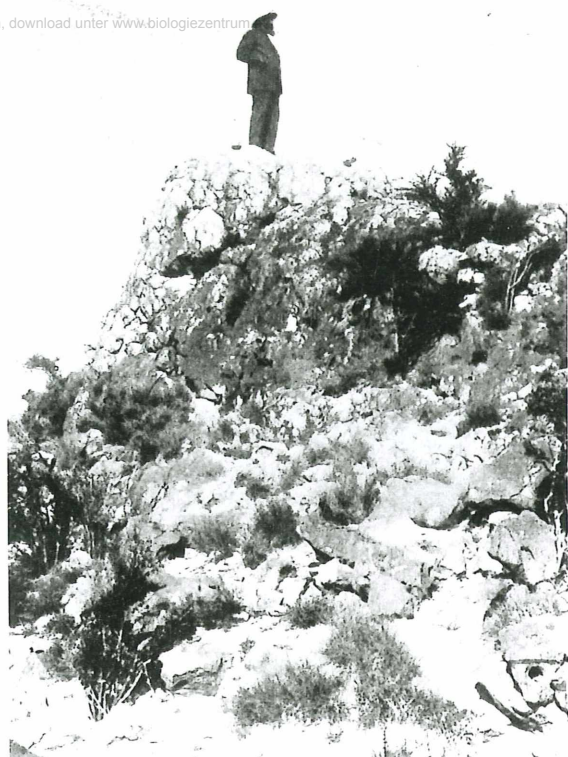


Fig. 16 Socotra Explorers:

Top left: David Heinrich Müller (1846-1912).

Top right: D. H. Müller on a rock on Socotra, photographed by O. Simony.

Bottom left: Franz Kossmat (1871-1938). - **Bottom right:** Oskar Simony (1852-1915).

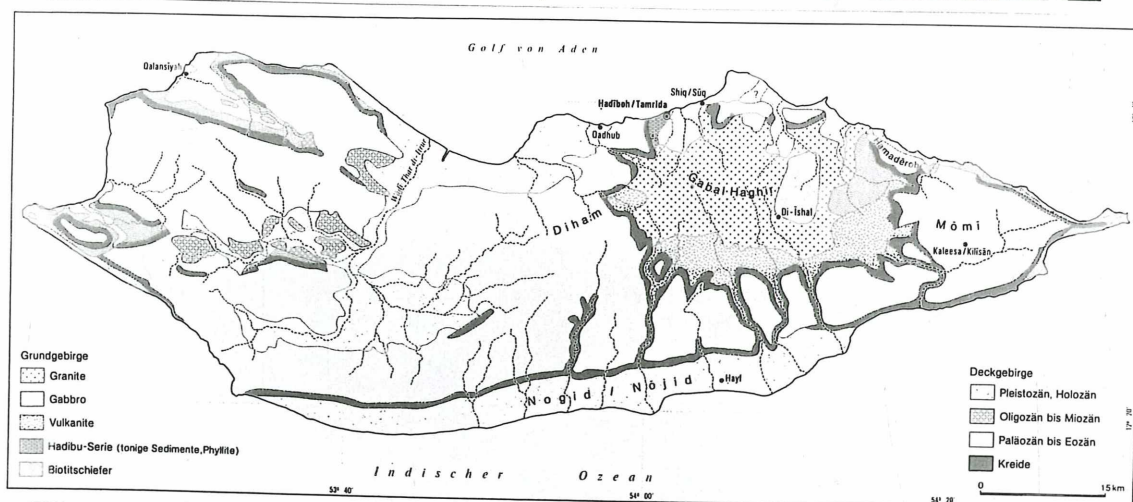
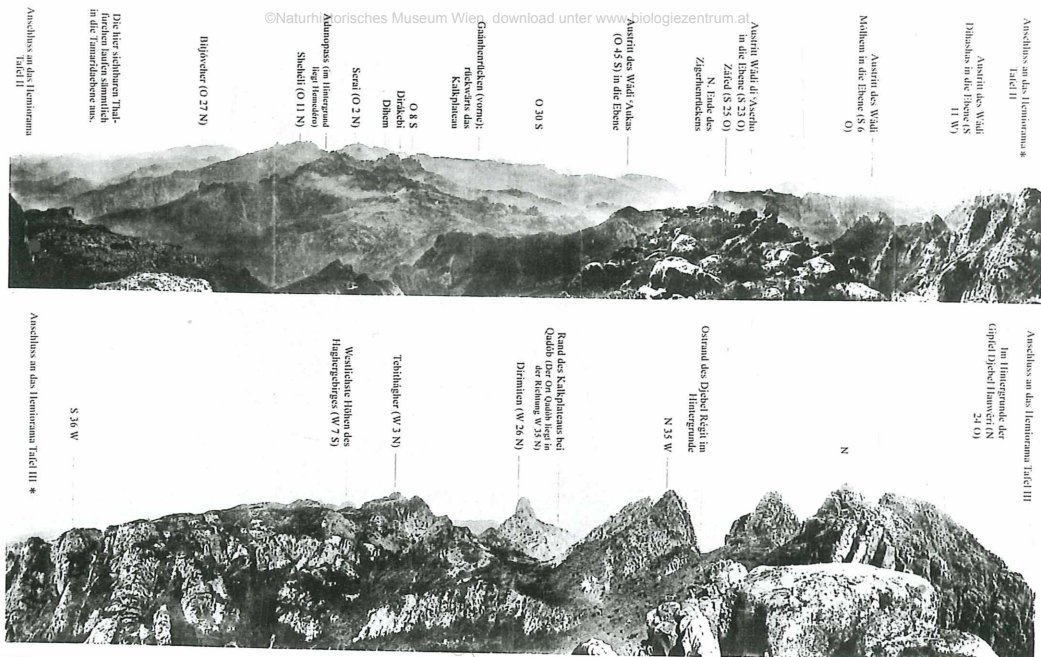


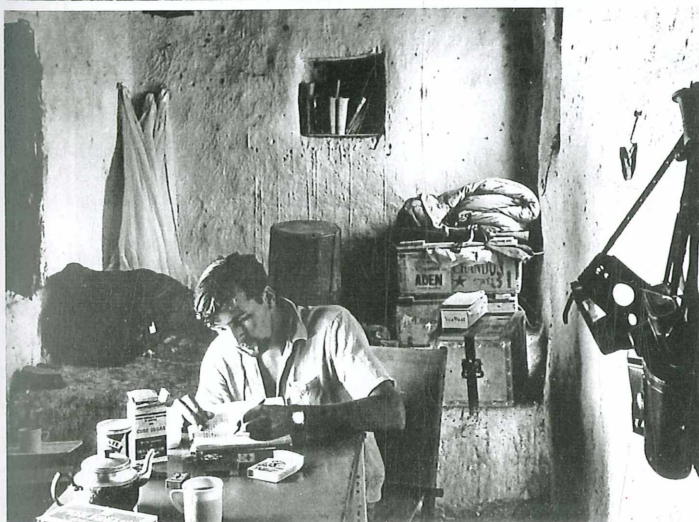
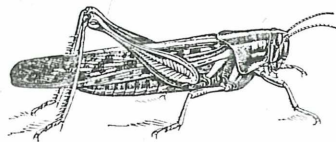
Fig. 17 Socotra Explorers:

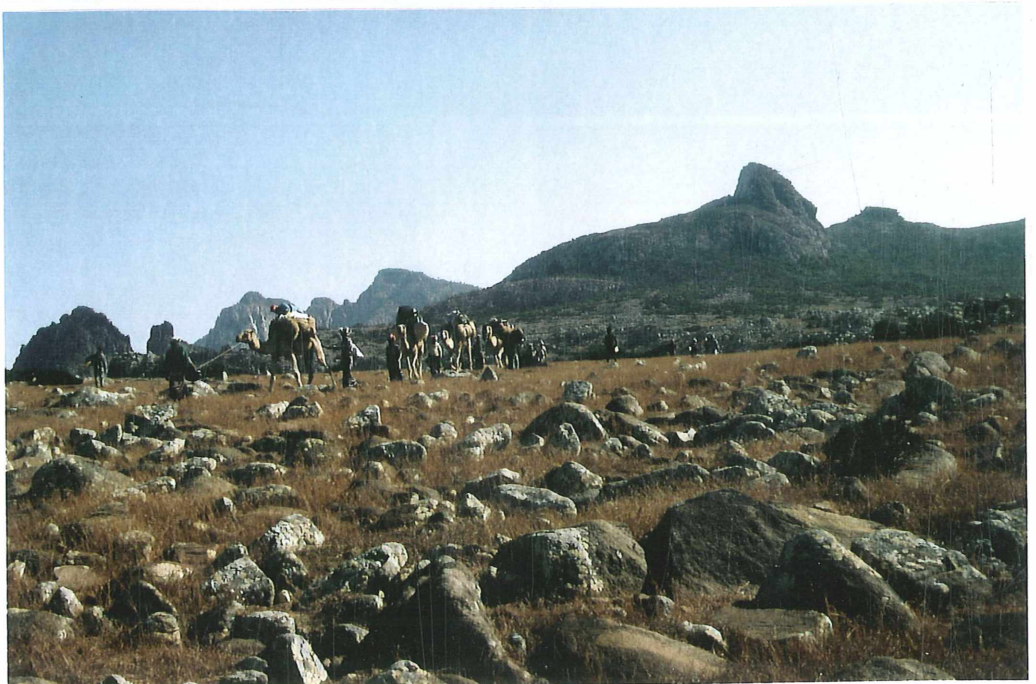
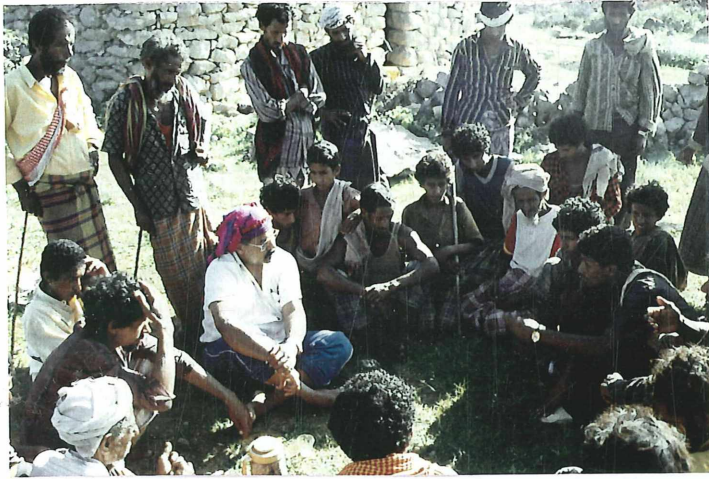
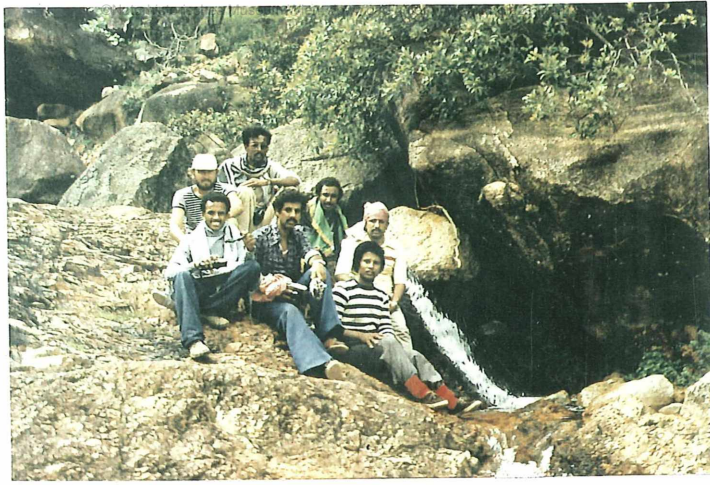
Top: View to the top of the Haghir mountains (from: Denkschriften der Kaiserlichen Akademie der Wissenschaften, mathematisch-naturwissenschaftliche Klasse, Band 71, 1. Halbband; k.u.k. Hof- und Staatsdruckerei, Wien 1907. Reproduced by kind permission of the Österreichische Akademie der Wissenschaften).

Bottom: Geological map of Socotra Island based on the work of KOSSMAT (1907).

Fig. 18 Socotra Explorers (next page / nächste Seite):

Top left: Dr. George Basil Popov (1922-1998). - **Top right:** Locust invasion on Socotra Island in winter 1953. Baiting hoppers by use of poisoned wheat bran (photo: POPOV). - **Middle:** Locust invasion on Socotra Island in winter 1953. Flying locusts in the Haghir (photo: POPOV). - **Bottom left:** Douglas Botting (born 1934) in the expedition house in Hadibo, August 1956 (photo: D. Botting, Oxford University Expedition to Socotra). - **Bottom right:** Kenneth Guichard (born 1914), zoologist in the Middle East Command Expedition 1967.





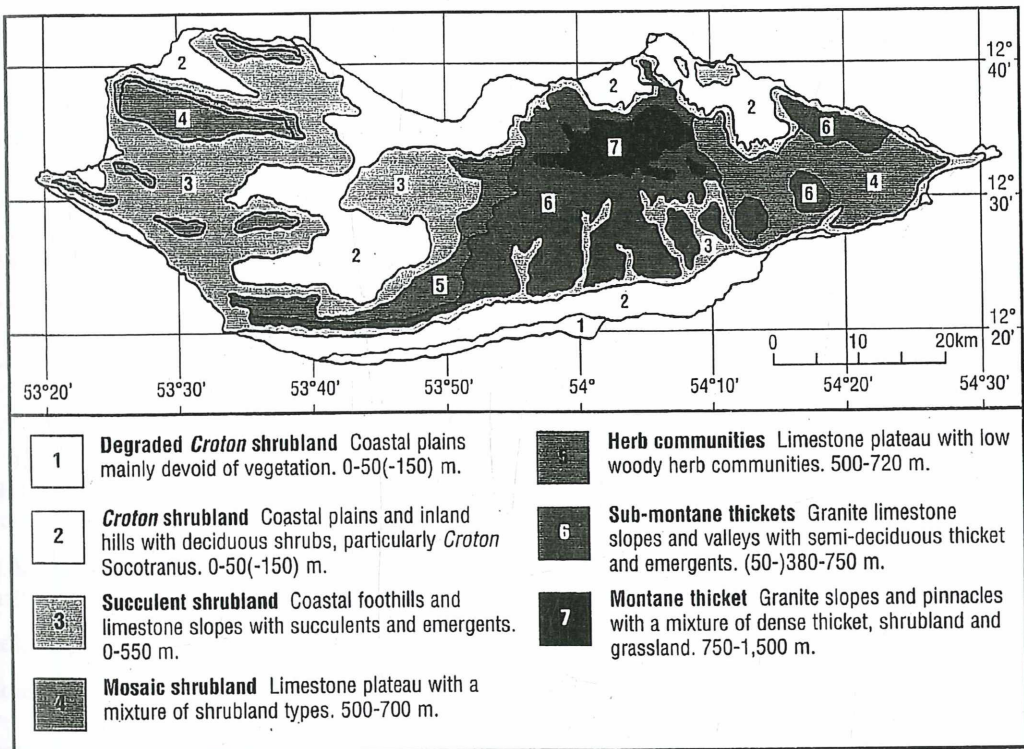
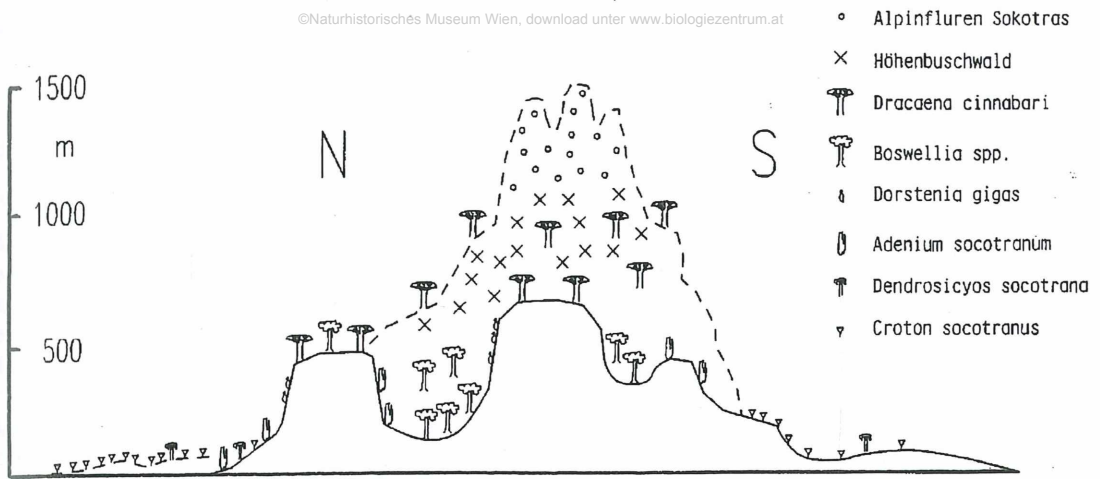


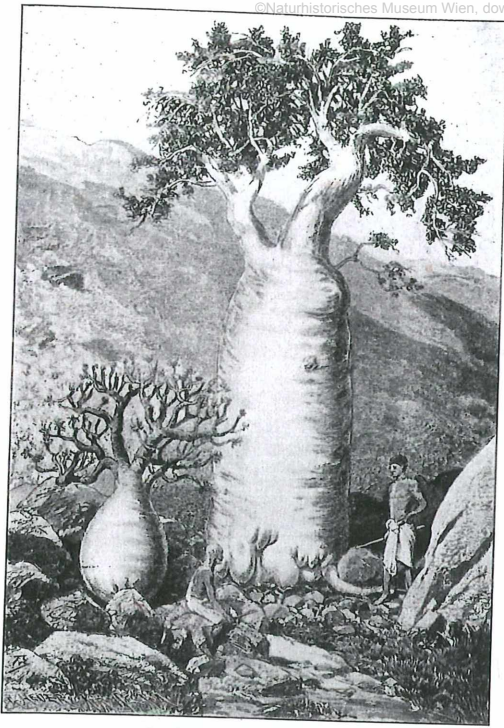
Fig. 20 Flora and Vegetation:

Topographical division and the main vegetation types on Socotra (MILLER in DAVIS et al. 1994, MIES et al. 1995).

Fig. 19 Socotra Explorers (previous page / vorige Seite):

Top: Members of the University of Aden Expedition 1982 in the Haghier mountains.

Middle: Talks were held with mountain dwellers in an effort to gain an understanding of traditional management methods and to explain them the aim of the biosphere project (UNESCO Fact Finding Mission 1993); and the Symbol of the Socotra Biodiversity Project.- **Bottom:** Members of the Multidisciplinary Expedition 1999 on the way to a base camp in the Haghier mountains.



Gambelbaum auf Sokotra

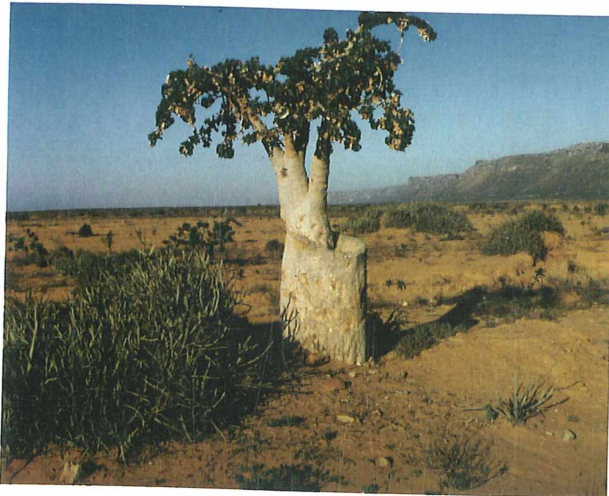
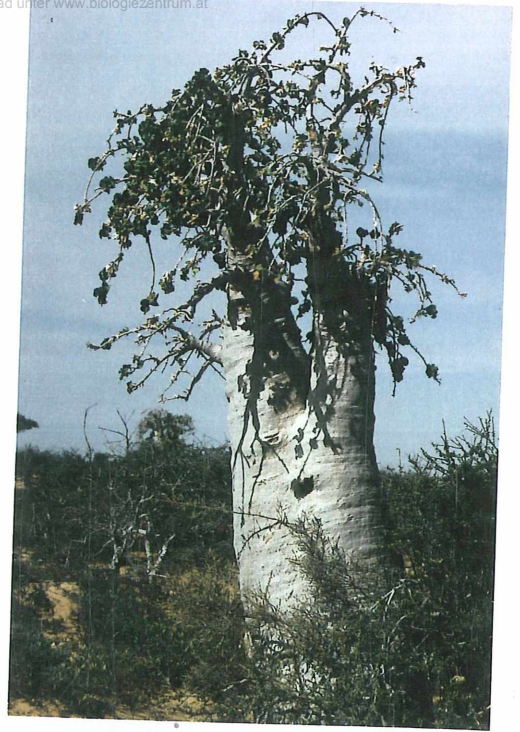


Fig. 21 (previous page / vorige Seite):

Top left: The bizarre tree succulents *Adenium* and *Dendrosicyos* (SCHWEINFURTH 1925).

The pachycaul tree *Dendrosicyos socotranus* BALF.f. (Cucurbitaceae), found on the coastal plain and rocky limestone slopes, has a bare, tapering chalky-white trunk up to 1 m wide and growth up to 6 m. The yellow and green flowers appear in the hot, dry season. They are large and unisexual, i.e. those of either sex usually appearing on separate plants, although both types may occasionally also be produced on the same plant. The fruits hanging from its branches look like small cucumbers, but are inedible. The endemic species, which has also been recorded for Samha, is the only tree member of the cucumber family and can be considered as an example of gigantism that may evolve under the absence of tall herbivores.

Fig. 22 (next page / nächste Seite):

Adenium obesum (Apocynaceae) is a widespread, variable species complex found in most of Africa and South Arabia, which has in the past been described as a number of separate species. The endemic subspecies *Adenium obesum sokotranum* VIERH. is the largest form with a more swollen and upright stem than its relatives have. These swollen bottle-shaped trunks keep the trees supplied with water during the summer droughts. The bizarre-looking „desert rose“ is common in open deciduous shrubland of the coastal plains and low inland hills. Most parts of the plant are poisonous, but the leaves are occasionally browsed by goats.

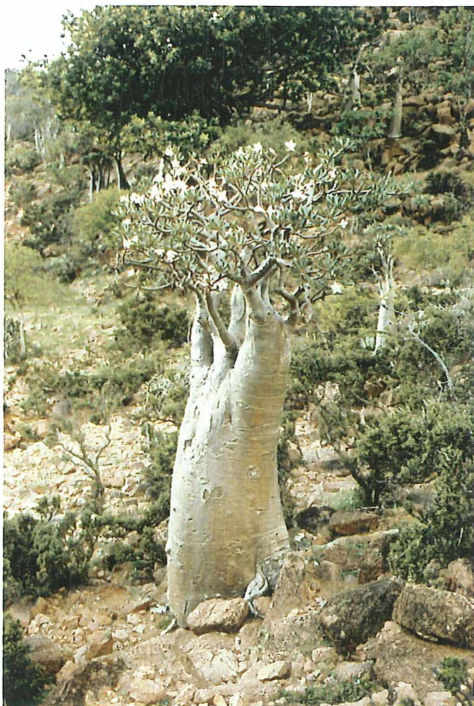
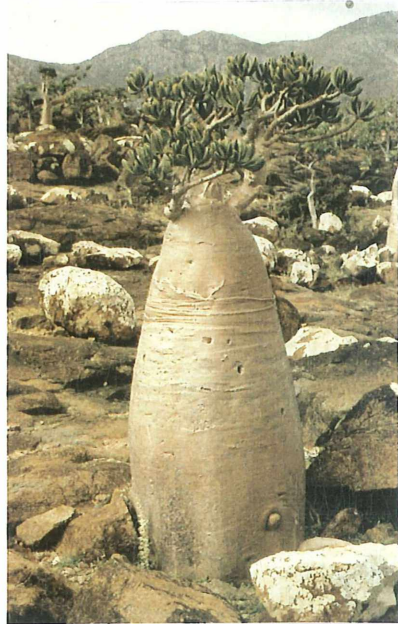
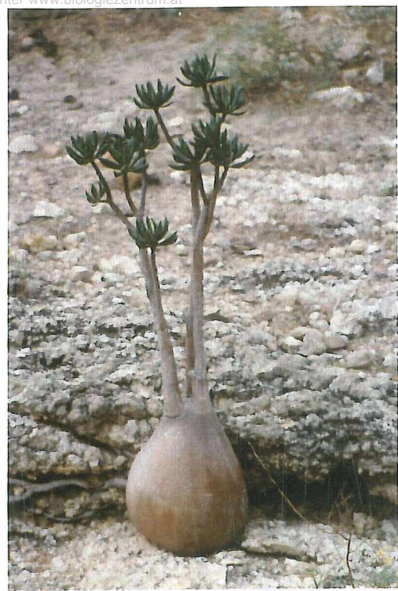
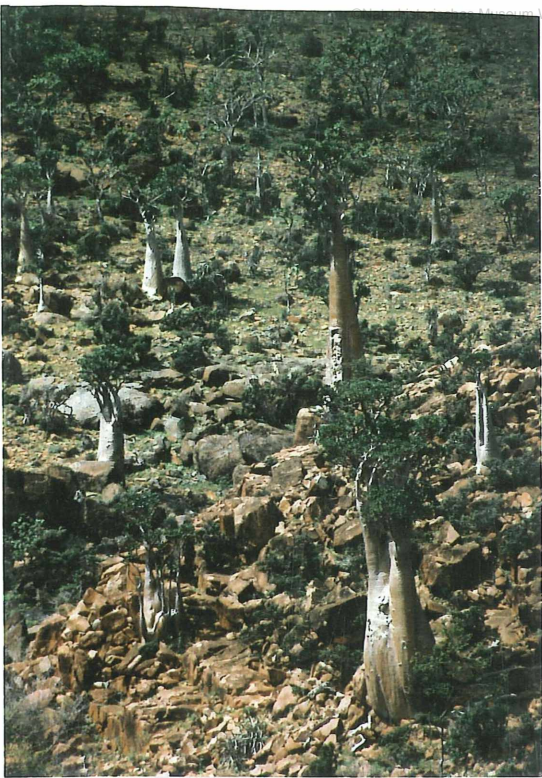
Fig. 23 (page 103 / Seite 103):

One of the most famous botanical curiosities of Socotra is the dragon's blood tree *Dracaena cinnabari* BALF.f. (Agavaceae), which is restricted to the zones of submontane thicket and montane grassland (only at around 500 m and above). Mature trees are tall, up to 8 m and can not be mistaken for any other.

Top & middle right: Diksam, in the centre of the island, is probably the best example of *Dracaena cinnabari* woodland.

Middle left: Diksam in the morning, covered in clouds.

Bottom: Sprays of dark red to black fruits, which are bird-dispersed or falling down to the ground. However seedlings or young trees are restricted to inaccessible sides of cliffs or rocks, so it can be supposed that young seedlings are overgrazed by the livestock.



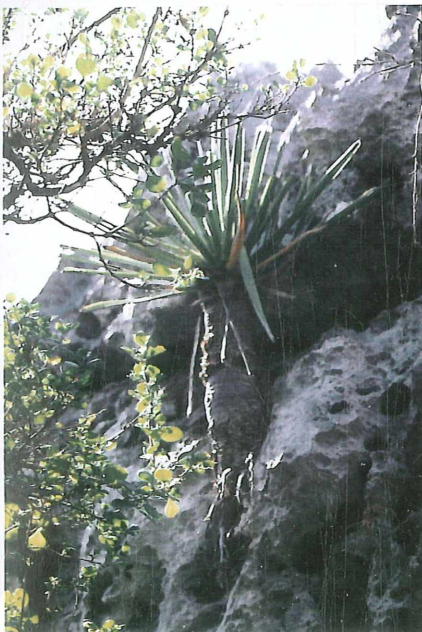
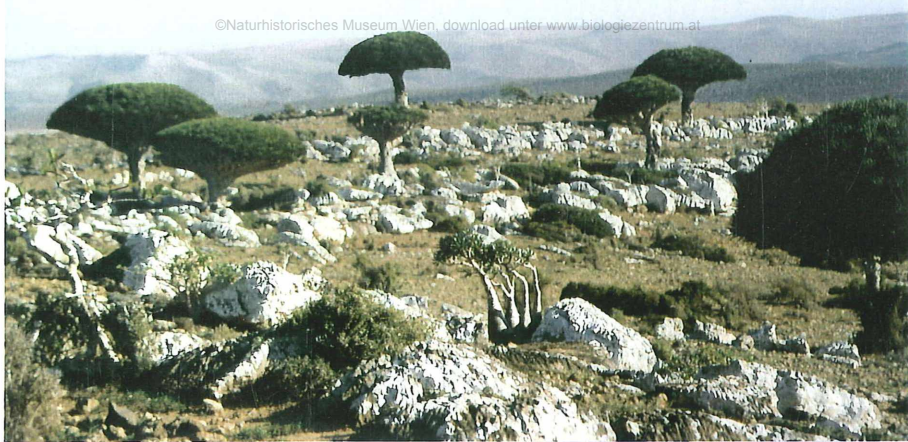


Fig. 24 Flora and vegetation (next page / nächste Seite):

Top: *Dracaena cinnabari* in the east of Socotra (Momi area).

Bottom left: Mountain dweller with a ball of red resin. Although it has no longer a commercial value, cinnabar is an important resource for the local people. They use it to cure stomach problems, dye wool, glue pottery, freshen breath, decorate pottery and houses and even use it as lipstick.

Bottom right: Local made Pots decorated with Dragon's blood.

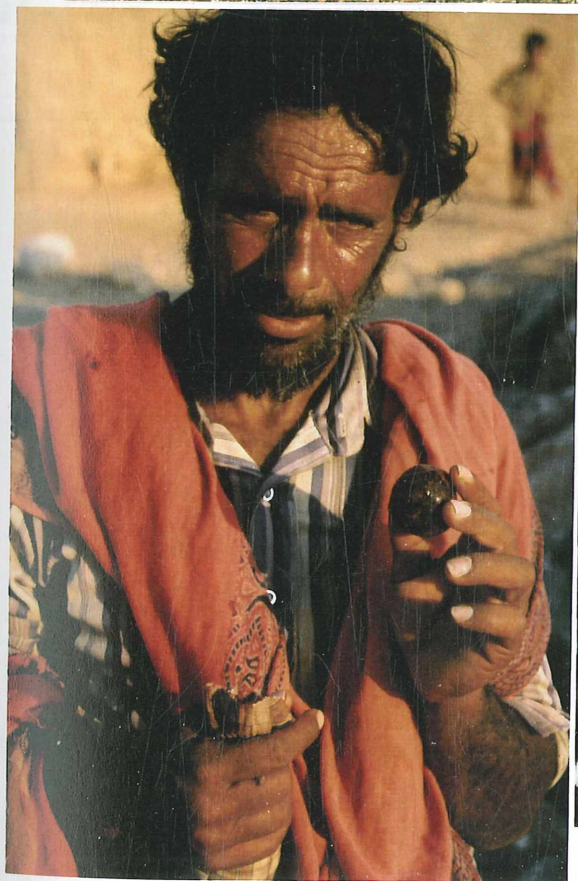
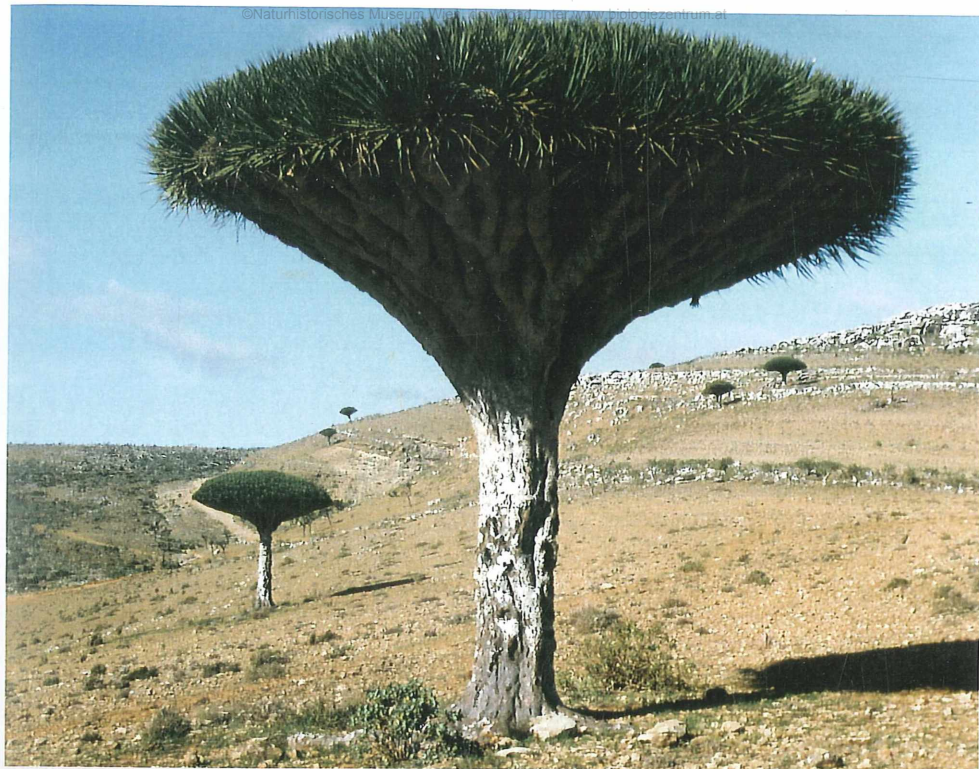


Fig. 25 Flora and vegetation (next page / nächste Seite):

Top: The open deciduous shrub land on the coastal plains and low inland hills is dominated by the endemic shrub *Croton socotranus* BALF.f. (Euphorbiaceae).

Middle: Another widespread endemic on coastal plains and rocky limestones is the large shrub or small tree *Euphorbia arbuscula* BALF.f. (Euphorbiaceae). It is characterized by a woody trunk and essentially leafless, with a bushy, spreading crown and grey-green, minutely roughened stems. The new shoots are flattened, green with fine hairs and bear tiny, scale-like leaves, which soon fall off, leaving the succulent branches to carry out the work of photosynthesis. *E. arbuscula* has a wide use. In dry areas and dry periods, herders chop the pointed tips of the branches to feed their animals, even if the milk and meat of goats are reputedly tainted. Medicinally, the latex is used to treat skin diseases and infestations. The dead wood burns very quickly, and with a lot of smoke, therefore it acts as an insect repellent. However it is also used as firewood in the production of lime from limestone or coral.

The latex of all species of *Euphorbia* should be handled with caution, because it is poisonous, usually highly irritant to skin and mucous membranes, and even may cause blindness if splashed into the eyes.

Bottom left: *Boswellia* sp. (Burseraceae). There are perhaps eight species of *Boswellia* on Socotra, some still to be described.

Bottom right: *Jatropha unicostata* BALF.f. (Euphorbiaceae) is a shrubby tree, up to 2 m high, with a whitish bark and large, lanceolate leaves and usually white flowers. It is endemic and common in the dry areas throughout the coastal plains and succulent shrubland. The latex acts as an antiseptic. It may be used on cuts, wounds and sores, especially for burns and inflammation, and forms a clear plastic skin over the healing skin area. The smoke of burning wood is also used to smudge animals against insects.

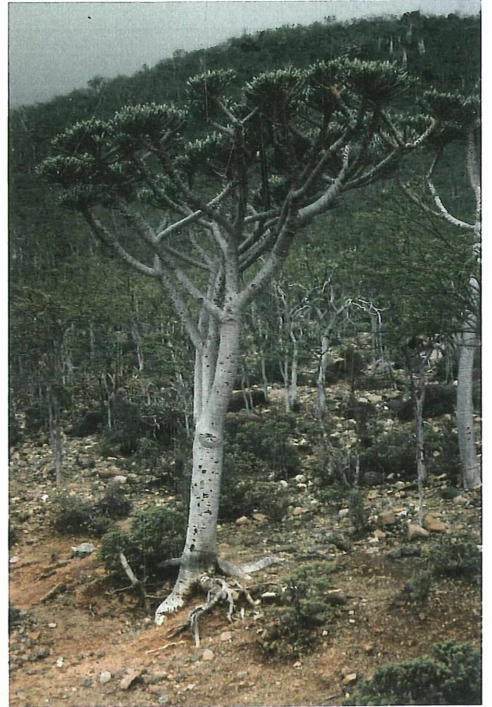
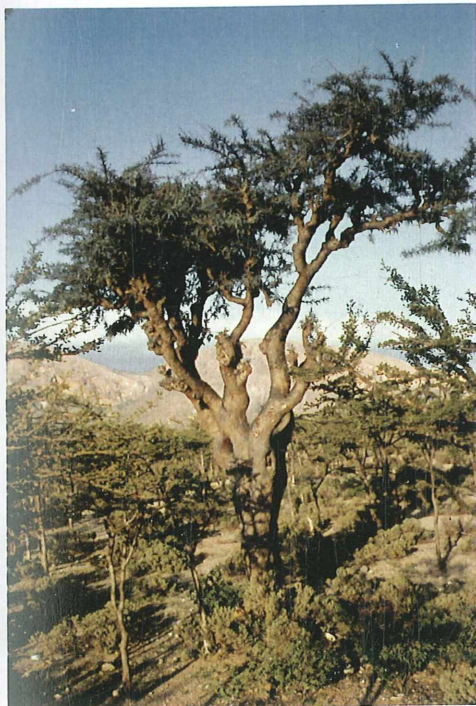


Fig. 26 Flora and vegetation (next page / nächste Seite):

Top left: *Tamarix* sp. (Tamaricaceae).

Top right: *Aerva* sp. (Amaranthaceae).

2nd left: *Euphorbia* aff. *obcordata* BALF.f. (Euphorbiaceae).

2nd right: *Cissus hamaderoensis* RADCL.-SM. (Vitaceae).

3rd: *Pulicaria stephanocarpa* BALF.f. (Asteraceae).

Bottom left: *Buxus hildebrandtii* BAILL. (Buxaceae).

Bottom right: *Suaeda vermiculata* [FORSK. ex] MELIN (Chenopodiaceae).

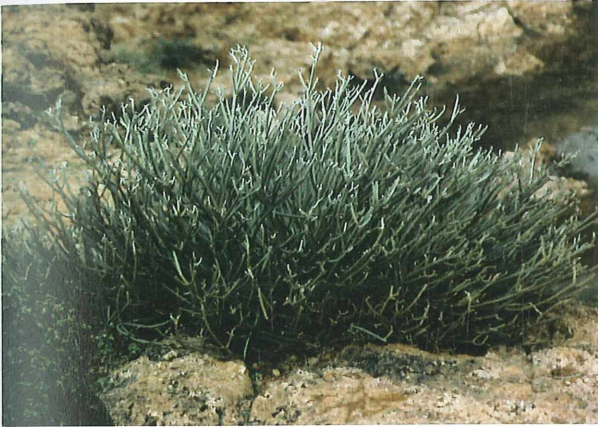
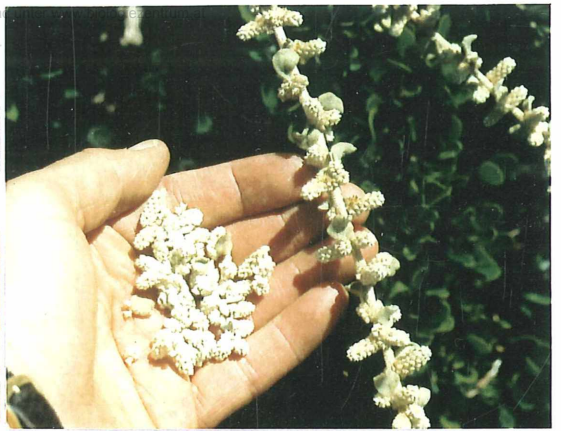


Fig. 27 Flora and vegetation (next page / nächste Seite):

Top left: *Anagallis arvensis* L. (Primulaceae).

Top right: *Exacum affine* BALF.f. (Gentianaceae).

2nd left: *Babiana socotrana* HOOK.f. (Iridaceae).

2nd right: *Ruellia patula* JACQ. (Acanthaceae).

3rd left: *Corbichonia* cf. *decumbens* (Aizoaceae).

3rd right: *Campylanthus spinosus* BALF.f. (Scrophulariaceae).

Bottom left: *Diceratella incana* BALF.f. (Brassicaceae).

Bottom right: *Tephrosia uniflora* PERS. (Fabaceae).

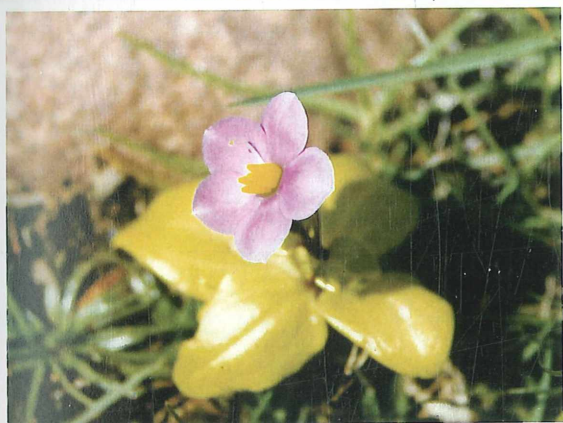
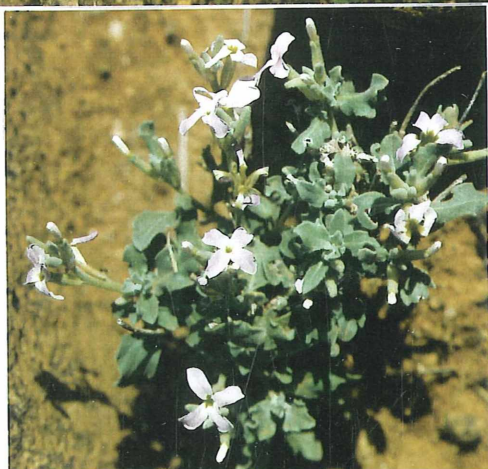
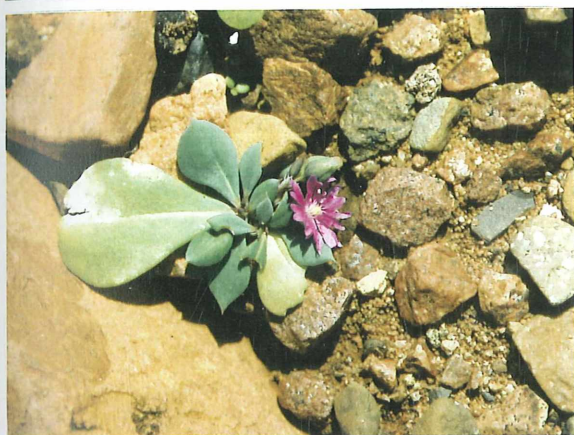
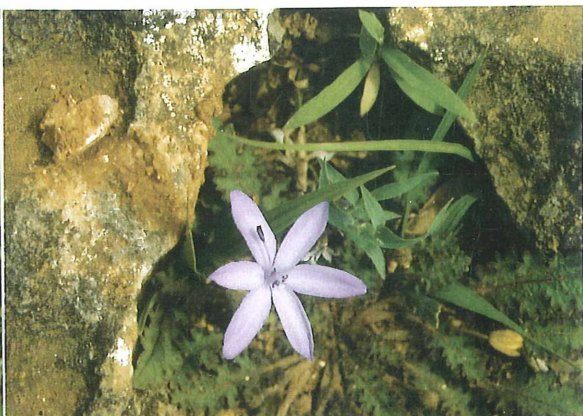


Fig. 28 Flora and vegetation (next page / nächste Seite):

Top: *Oldenlandia pulvinata* (BALF.f.) VIERH. (Rubiaceae).

2nd left: *Oldenlandia balfouri* BREMEK. (Rubiaceae).

2nd right: *Heliotropium balfouri* GÜRKE (Boraginaceae).

3rd left: *Cucumis prophetarum* L. (Cucurbitaceae).

3rd right: *Argemone mexicana* L. (Papaveraceae).

Bottom left: *Corchorus erodioides* BALF.f. (Tiliaceae).

Bottom right: *Helichrysum balfouri* (BALF.f.) VIERH. (Asteraceae).

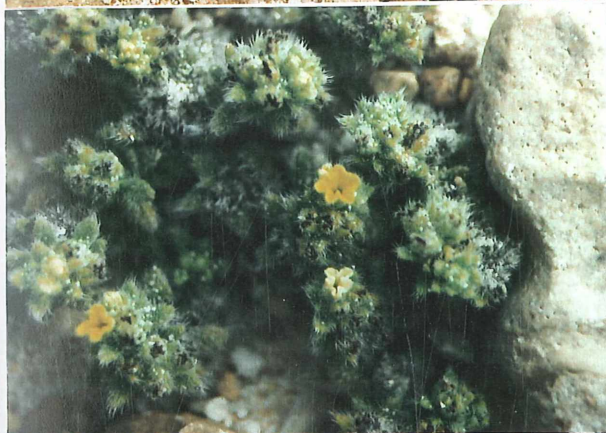


Fig. 29 Flora and vegetation (next page / nächste Seite):

Top left: *Cleome socotrana* BALF.f. (Capparaceae).

Top right: *Portulaca oleracea* L. (Portulacaceae).

2nd left: *Pergularia tomentosa* L. (Asclepiadaceae).

2nd right: *Polycarpaea* sp. (Caryophyllaceae).

3rd left: *Hypoestes forskalei* (VAHL) SO. ex ROEM. & SCHULT. (Acanthaceae).

3rd right: *Indigofera* sp. (Fabaceae).

Bottom left: *Priva socotrana* MOLDENKE (Verbenaceae).

Bottom right: *Convolvulus sarmentosus* BALF.f. (Convolvulaceae).

Fig. 30 Flora and vegetation (page 116/ Seite 116):

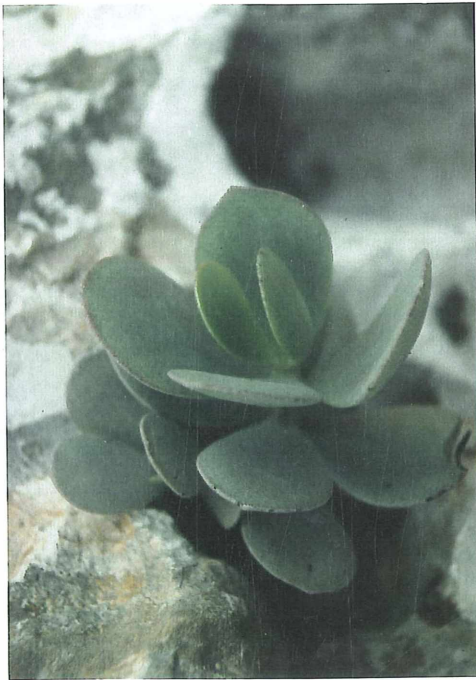
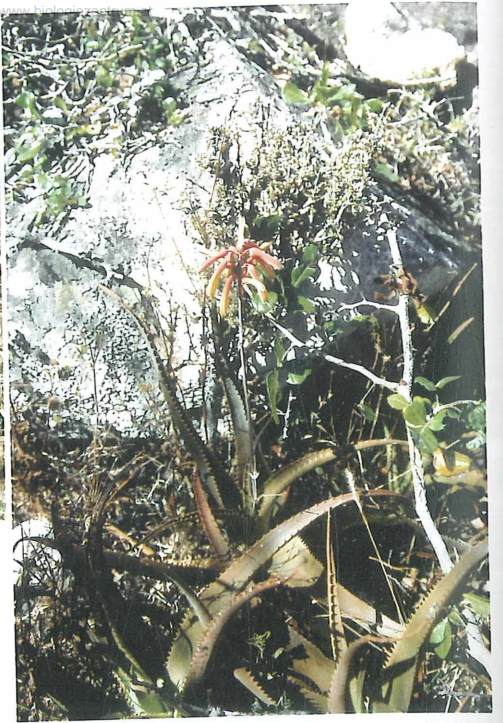
Top: *Aloe perryi* BAKER (Aloaceae).

There are two or three endemic, and related species of *Aloe* on Socotra. While *Aloe squarrosa* BAKER in BALF.f. is distinctive and confined to a few cliffs near to Qalansiyah, *A. forbesii* BALF.f. is very similar to *A. perryi*, and probably only an ecotype. *A. perryi* is scattered throughout the island, and common particularly on the limestone plateau. Its leaves are large, fleshy, and grey-green, with spiny margins. The pannicles are about one metre high and with variable yellowish to red flowers. The juice of the plant is collected by cutting the leaves at the base and leaving the cut ends to drain over a goatskin for a few hours. The exudate dries out slowly over a month into a more viscid consistence, and becomes hard and crystalline if it dries out further. Aloe is used by the islanders as a purgative and is still exported in small quantities to mainland Arabia.

Middle: *Kalanchoe* sp. (Crassulaceae).

Bottom: *Caralluma socotrana* (BALF.f.) N.E. BROWN is a colourful endemic asclepiad (Asclepiadaceae). The plant is protected from the grazing livestock by bitterly substances. Its flowers have a decaying smell and are attractive for a number of beetles and flies.





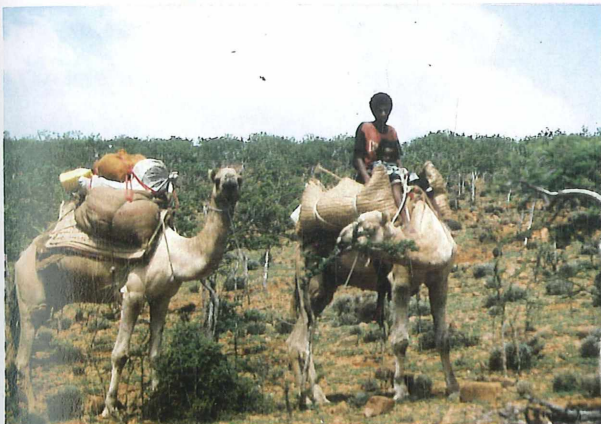
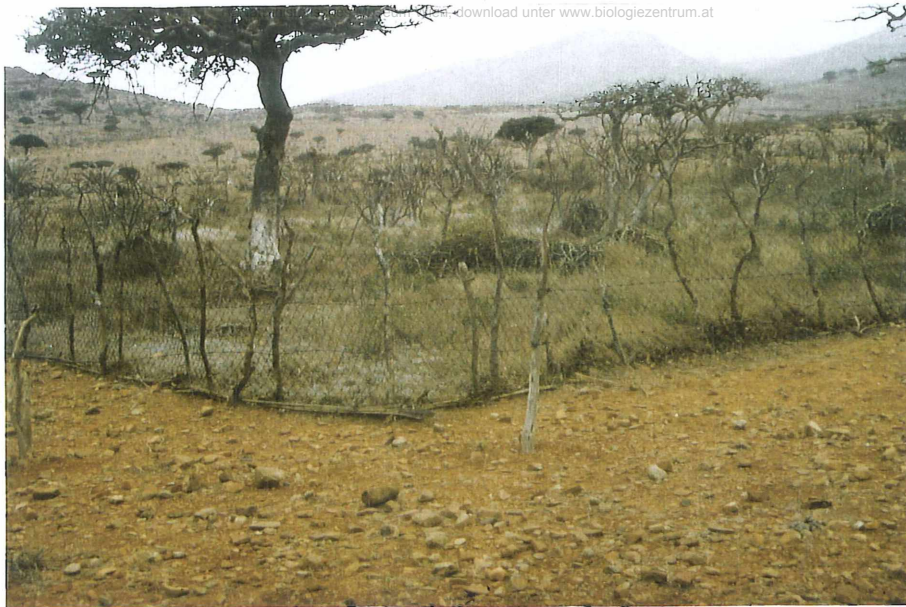


Fig. 31 Mammals:

Top: Exclosure at Homhil after a period of about one year. The difference between the vegetation in and out this testing area gives an impressive idea on the intensity of grazing. The greater number of livestock graze freely without any restriction, only sheep are actively herded.

Middle left: Dromedary. - **Middle right:** Socotra cattle and sheep.

Bottom left: Goat. - **Bottom right:** Donkey.

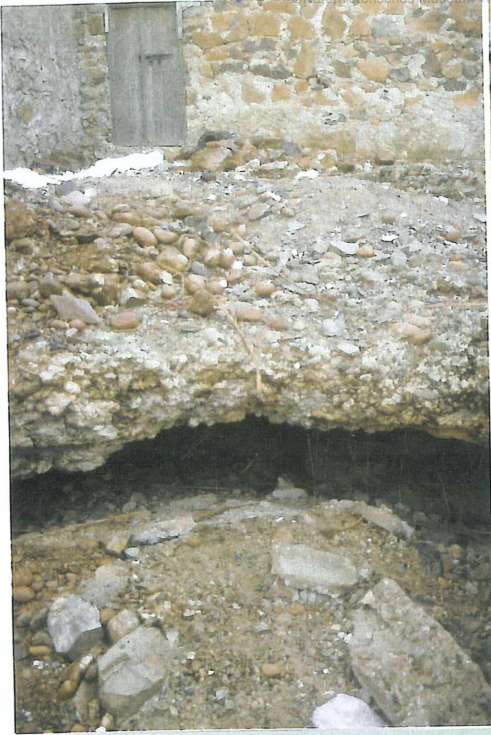


Fig. 32 Mammals (previous page / vorige Seite):

Top: *Rhinopoma hardwickei* GRAY, 1831 (Lesser Mouse-tailed bat) in a cave in Hadibo. The name *Rhinopoma* means „nose-lid“, an obvious peculiarity of this species. Another distinct character is the long mouse-like tail. Specimens were found roosting in small groups in caves in Hadibo and Diksam.

Middle left: *Suncus etruscus* (SAVI, 1822) (Pigmy shrew). Very little is known of the biology and the ecological needs of this small mammal, which seems to be versatile in habitats. It is superficially mouse-like, but has the typical tube-like shrew nose and is characterized by many long fine hairs all over its tail and parts of its body.

Middle right: *Mus musculus* LINNAEUS, 1758 (House Mouse) in Hadibo.

Bottom: *Rattus rattus* (LINNAEUS, 1758) (Black or House Rat). Both Muridae occur throughout most of the world as a result of commensalism with man. They are common, but rarely seen.

Fig. 33 Mammals (next page / nächste Seite):

Top left: Domestic cat in Hadibo.

Middle: *Viverricula indica* (DESMAREST, 1804), the Lesser Indian Civet Cat. The species, which belongs to the mongoose family (Viverridae) is widely distributed throughout central and southern Asia, southern China and the Sunda Islands, it was introduced to Madagascar, the Comoro islands, Zanzibar and Socotra. On Socotra it seems to be common, but is rarely seen. As food it takes small vertebrates, arthropods and fruits.

Bottom: Dolphins are common in the coastal waters of Socotra, and occasionally dead specimens can be found washed ashore. The illustrated specimen belongs to *Delphinus cf. capensis* GRAY, 1828 (Bauer, Naturhistorisches Museum Wien, i.l.)

Terrestrial and Freshwater Fauna

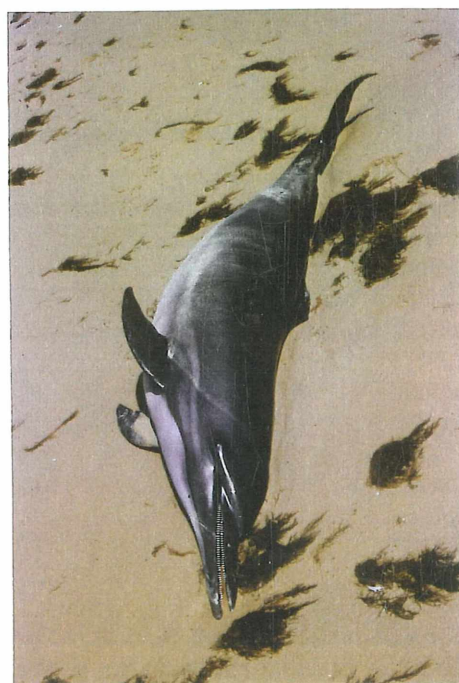
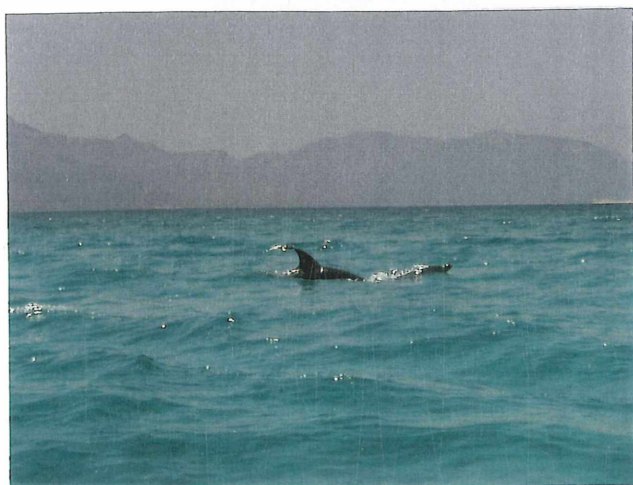
Equally fascinating is the land and freshwater fauna, with an exceptional number of endemics, although not so striking and comparatively poorly studied. Altogether about 800 species have been recorded, but most of these date back to the major expeditions about a hundred years ago. Many need confirmation and a critical taxonomic revision (Tab. 1 & 2).

About 13 species of mammals are known from the Archipelago, but until now, with the exception of the bats, all of them seem to have been introduced by man (WRANIK et al. 1991). BOTTING (1958) considers the absence of indigenous mammals as an indication of the islands ancient origin, presumably from a time before mammals appeared on earth. Because of the unspectacular species structure mammals have received relatively little attention (Figs. 31-33).

No exact data is available about mammal livestock (Fig. 31), the only estimate is from 1985; Goats, 70 000; sheep, 17 000; camels, 500 and cows about 1 800.

The Socotran cows are well adapted to the harsh island conditions and have the distinguishing characteristics from the typical mainland forms, being a dwarf variety without a hump. They are supposed to be descendants from a South Arabian species of horned cattle that was bred here in ancient times (NAUMKIN 1993). There are many donkeys, which resemble in their appearance the Nubian Wild Ass (*Equus asinus africanus* (LINNAEUS, 1758)), which is considered to be extinct in the wild.

The actual livestock numbers seem to be already clearly at the maximum levels that water and vegetation can support. As yet there was no practicable way to provide supplementary fodder and water during the summer time, so drought and diseases, sometimes epidemic, continued to provide a control on livestock numbers. If livestock in future is supported by an artificial water supply and the importation of



supplementary food an increase in number is most likely, or even if a disruption of the complicated patterns of seasonal livestock movement occurs, it can be expected that the present fragile equilibrium between vegetation, man and livestock will be destroyed very quickly. The vegetation plays also a key role in holding the soil onto the slopes and reducing the surface run off of water. Therefore any removal of the vegetation cover, which could also be forced by a less strict control of the higher demand of wood for various purposes (heating, cooking requirements, fuel for the manufacture of lime, building material), would result in accelerated soil erosion and the loss of surface water through increased run-off rates creating a dangerous, downward spiral for the island and its biota as well.

One record of a dead shrew (*Suncus etruscus* (SAVI, 1822)) is reported by Guichard (DOE 1992). However the catching of a living shrew in spring 1999 (JÖGER, pers. inform.) may be a scientific surprise, as the unidentified specimen does not seem to fit into the scheme of known species. The status of bats is also unclear. Three species (*Rhinopoma hardwickei* GRAY, 1831; *Asellia tridens* GEOFFREY, 1813 and *Pipistrellus bodenheimeri* (HARRISON, 1960)) have been recorded (WRANIK et al. 1991; HARRISON & BATES 1991; DOE 1992). Most common was *Rhinopoma hardwickei*, which were found resting in caves in Hadibo and in the mountains, as well as on Samha and Abd al Kuri (Fig. 32). The sounds of flying bats were recorded in the dark on various occasions using a bat detector but they could not be identified. People in the mountains are quite familiar with bats and are not afraid of them. If necessary, they expel them from the caves with help of branches. According to their observations bats occur more or less regularly and sometimes in a greater number, but they do not distinguish between different species. There have been no records of young bats, and it is also unknown, how far bats migrate between the mainland and the islands.

Rats (*Rattus rattus* (LINNAEUS, 1758)) seem to be widespread on all islands of the archipelago, and according to the reports of fishermen, they are very numerous on the small island of Darsa. On Socotra they are rarely seen, even in those places of villages where rubbish has accumulated. It might be, that there is a food competition between them and goats, sheep and vultures. Although there seems to be no special danger, babies are often suspended in a cloth bundle from the roof, out of reach of rats, centipedes and other crawling invertebrates.

For a long time the only evidence for the presence of *Mus musculus* LINNAEUS, 1758 was a single record by Riebeck in 1881, but in 1999 we caught specimens on Samha and Socotra. It can be supposed, that there are both wild and domestic population of the House Mouse. The local people distinguish between „rats“ and „mice“, but only by size.

The Lesser Indian Civet Cat (*Viverricula indica* (DESMAREST, 1804) (*V. malaccensis* (GMELIN, 1788)) difficult to interpret at the present (Bauer, Naturhistorisches Museum Wien, i.l.) is reported to be fairly common, sometimes visiting the villages and even the houses. They are still caught to extract the musk in glands below the tail. After collecting musk they are allowed to escape. Whereas the „Wild Cats“, which are reported to live in the mountains, are caught by iron traps and are killed. But these „wild“ cats are probably feral descendants of domestic cats, which are found in the coastal villages and some mountain settlements as well (Fig. 33).

More than 120 bird species have been recorded so far, 31 of which are known, or supposed, to breed (AL-SAGHIER & PORTER 1996) (Fig. 34 - 40). Among the landbirds at least 6 species, as well as 11 subspecies, are restricted to the archipelago. More work is still needed to clarify the status of some of them, as for example the highly isolated population of Socotra *Buteo* (MARTINS & PORTER 1996). Endemic species are *Cisticola haesitatus* SCLATER & HARTLAUB, 1881; *Cisticola incanus* SCLATER & HARTLAUB, 1881; *Emberiza socotrana* GRANT & FORBES, 1899; *Nectarinia balfouri* (SCLATER & HARTLAUB, 1881); *Onychognathus frater* (SCLATER & HARTLAUB, 1881) and *Passer insularis* SCLATER & HARTLAUB, 1881. Beside these endemics, Socotra holds a significant world population of some species, such as the Egyptian Vulture *Neophron percnopterus* (LINNAEUS, 1758), where the OSME Expedition estimated the number of breeding pairs to be around 1 000 (PORTER & STONE 1996) (Fig. 36). Along the coastline moves a great number of migrant species many of which are thought to overwinter. Some of the coastal habitats are exceptionally rich, and numerous waders and seabirds occur (Figs. 34-35).

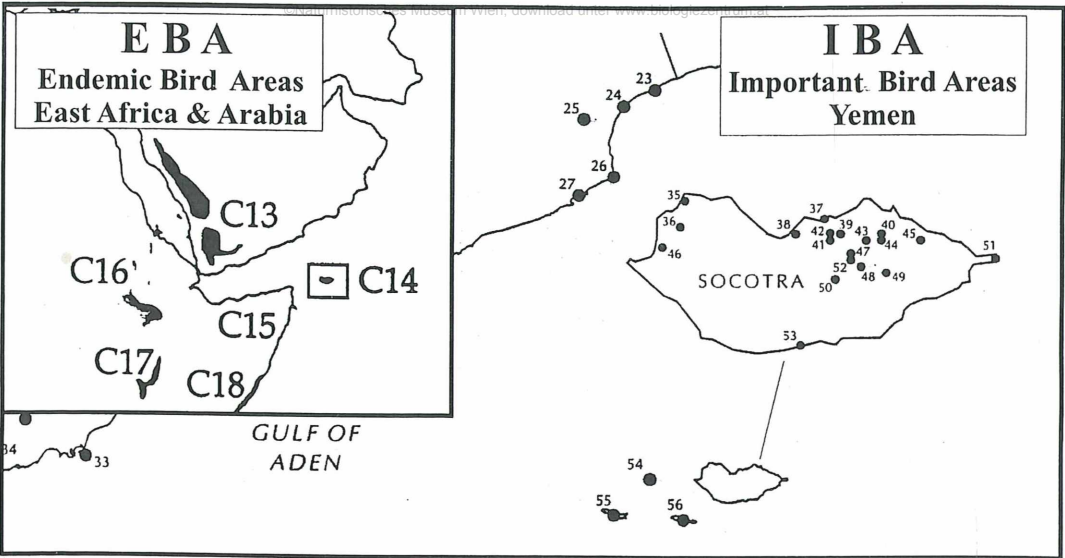


Fig. 34 Birds (previous page / vorige Seite):

Top: Map of globally important Endemic Bird Areas (EBAs) and Important Bird Areas (IBAs) (BirdLife International).

Endemic Bird Area is a category used by BirdLife International to describe areas with two or more restricted-range bird species entirely confined to them.

Important Bird Areas is a category used by BirdLife International and the Ornithological Society of the Middle East to describe areas with

- species threatened with global extinction
- species which concentrate in large numbers at, and are dependent on, particular sites either when breeding, on migration, or during winter
- species which are threatened or declined throughout all or large parts of their range in the Middle East
- species that have relatively small total world ranges, with important populations in the Middle East
- sites for rare, threatened or unique habitats, or outstanding representative examples of natural habitats, which support characteristic associated assemblages of bird species
- sites important for the conservation of wild bird populations because of their proven or potential value for increasing environmental awareness, for carrying out appropriate research, or for sustainable eco-tourism

Middle left: Greater Flamingoes (*Phoenicopterus ruber* LINNAEUS, 1758) at a lagoon near Gubbah and a Grey Heron (*Ardea cinerea* LINNAEUS, 1758) at an estuary in Hadibo. Both species are considered as passage migrants.

Bottom left: Socotran Cormorant (*Phalacrocorax nigrogularis* GRANT & FORBES, 1899). The species is endemic to the shores and islands of southern Arabia and the Arabian Gulf. For Socotra it is considered as a non-breeding visitor, because although recorded at all the islands in the archipelago, breeding has not been proven.

Bottom right: Black-winged Stilt (*Himantopus himantopus* (LINNAEUS, 1758)) and Sooty-Gull (*Larus hemprichii* BRUCH, 1853) at Qalansiyah. The wader is a passage migrant, while the gull is a common non-breeding visitor.



Fig. 35 Birds (previous page / vorige Seite): (next page / nächste Seite):

Top: Redshank (*Tringa totanus* (LINNAEUS, 1758)) (left) and Greenshank (*Tringa nebularia* (GUNNERUS, 1767)) (right), Hadibo shore. Both are passage migrants.

Middle left: Turnstone (*Arenaria interpres* (LINNAEUS, 1758)), estuary near Hadibo. The species is a winter visitor.

Middle right: Whimbrel (*Numenius phaeopus* (LINNAEUS, 1758)), Hadibo plain. It is a common passage migrant and presumably also a winter visitor.

Bottom left: Palm Dove (*Streptopelia senegalensis* (LINNAEUS, 1766)) in a date palm grove near Hadibo. It is a common breeding resident, often recorded around habitations.

Bottom right: Lichtenstein's-Sandgrouse (*Pterocles lichtensteinii lichtensteinii* TEMMINCK, 1825). The resident breeder, which is well camouflaged, occurs usually in small groups.

Fig. 36 Birds (next page / nächste Seite):

Top left: A Buzzard (*Buteo buteo* ssp.) caged in Hadibo. The systematic position of this endemic and isolated resident is still unclear and requires further study.

Top right: Kestrel (*Falco tinnunculus* LINNAEUS, 1758). This resident breeder is widespread and common on Socotra.

Middle: Juvenile (right) and adult (left) Egyptian Vulture (*Neophron percnopterus*).

Bottom: Egyptian Vultures feeding on the Hadibo shore. *Neophron percnopterus* (LINNAEUS, 1758) is a resident and one of the most obvious birds on Socotra. We did not see the species on Samha and Abd al Kuri.



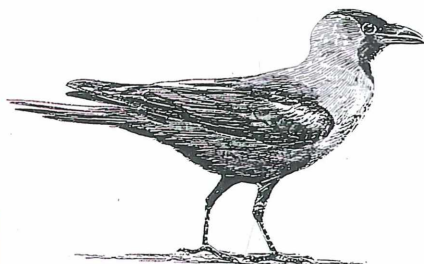


Fig. 37 Birds (previous page / vorige Seite):

Top left: African Scops Owl (*Otus scops socotranus* GRANT & FORBES, 1899) (from FORBES 1903). It is a widespread breeding resident in wooded areas.

Top right: European Roller (*Coracias garrulus* LINNAEUS, 1758), a vagrant.

Middle left: Brown-necked Raven (*Corvus ruficollis ruficollis* LESSON, 1830-1831), airport area. It is considered as a resident breeder, also if nesting have never established.

Middle right: Indian House Crow (*Corvus splendens* VIEILLOT, 1817), Hadibo.

Four specimens of the Indian House Crow (drawing) were observed in autumn 1997 in Hadibo for the first time. The people said, that a sailor brought a greater number of them on purpose from Aden to „bad the island“. Despite if this is true or not, it should be borne in mind, that the same species increased its population in Aden from „a few“ in the 1950's to about 2 million (!) specimens by the 1980's. The crow was finally declared a „national problem“ in the former South Yemen.

Bottom: Great Grey Shrike (*Lanius excubitor uncinatus* SCLATER & HARTLAUB, 1881), Diksam plateau. Nesting on a tree (*Ziziphus spina-christi* (LINNAEUS) DESFONTAINES (1798)), Wadi Truman.

Fig. 38 Birds (next page / nächste Seite):

Top left: Black-crowned Finch-Lark (*Eremopterix nigriceps forbeswatsoni* RIPLEY & BOND, 1966). The race of this common breeding resident is endemic to Socotra.

Top right: White-breasted White-eye (*Zosterops abyssinica socotrana* NEUMANN, 1808), Hadibo. A resident breeder.

Middle left: Desert Wheatear (*Oenanthe deserti deserti* (TEMMINCK, 1825), Samha. The species is considered as a winter visitor.

Middle right: Long-billed Pipit (*Anthus similis sokotrae* HARTERT, 1917), a common resident breeder on Socotra.

Bottom left: Socotra Sunbird (*Nectarinia balfouri* (SCLATER & HARTLAUB, 1881)), Diksam plateau. The endemic resident breeder is widespread and fairly common on Socotra from the coastal plain up to the mountains. It is most abundant in well vegetated areas. The sexes are similar and therefore usually not separable in the field. Nectar seems to be a less important part of the diet, but this needs further studies.

Bottom right: Golden-winged Grosbeak (*Rhynchostruthus socotranus socotranus* SCLATER & HARTLAUB, 1881), Diksam plateau. The species is considered as a resident breeder.

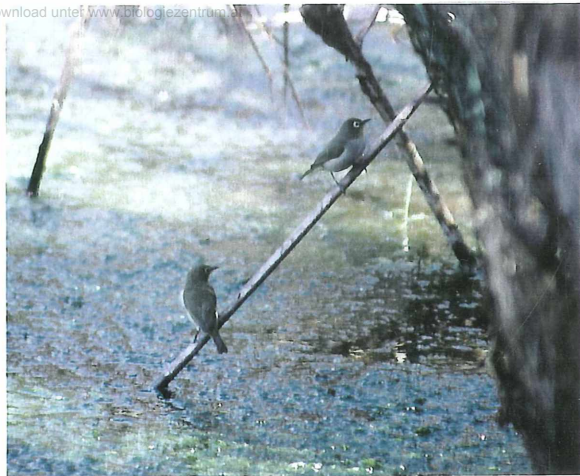


Fig. 39 Birds (next page / nächste Seite):

Top: Male Somali Starling *Onychognathus blythii* (HARTLAUB, 1881) at Samha (left) and female *O. blythii* feeding around grazing cattle at Diksam (right). The Somali Starling is a resident breeder on Socotra, Abd al Kuri and Samha, it also occurs in northern Somalia, northern Ethiopia and Eritrea. The sexes differ and are easy to distinguish.

There are two resident species of starling on the archipelago. *Onychognathus blythii*, the Somali Starling, is common and widespread, while *Onychognathus frater* (SCLATER & HARTLAUB, 1881), the Socotra Starling, is more local. RIPLEY & BOND (1966) suggest that *O. frater*, which is endemic to the island, evolved from a common ancestor that arrived from the mainland a considerable time before *O. blythii*, at least long enough for the development of mechanisms in the pioneer species to prevent random meeting when the Somali Starling colonized the island.

Both species prefer areas where trees are present, but can be also seen in gardens in the villages. They are very vocal and occur usually in pairs or small groups. Their diet consists of fruits and arthropods. The Somali Starling often appears in the surrounding of crazing cattle.

Middle left: Socotra Starling *Onychognathus frater*, Firmihin. The sexes are alike. It is slightly smaller than *O. blythii* with a shorter, squarer ended tail, and a longer, thinner bill. The Socotra Starling is more closely associated with trees.

Middle right: Sokotra Sparrows (*Passer insularis* SCLATER & HARTLAUB, 1881), Hadibo. This endemic resident breeder is widespread and common on Socotra, Samha and Abd al Kuri (*P. hemileucus* OGILVIE-GRANT & FORBES, 1900). Nesting seems to occur throughout the year.

Bottom: Male (left) and female (right) specimen of *Passer insularis*, Samha.





Fig. 40 Birds (previous page / vorige Seite):

Methods of bird trapping on Socotra.

Top: The gum-like resin of the tree *Euphorbia socotrana* BALF.f. is used for the preparation of lime-twigs.

Middle: Net-trap on the shore of Qalansiyah.

Bottom: Cage-trap with ripe dates as bait, Hadibo.

According to BirdLife International Socotra is one of 221 globally important Endemic Bird Areas (EBAs), as well as the south-west Arabian mountains on the mainland of Yemen (ICPB 1992). Yemen is thus unique amongst countries in the Middle East in having two EBAs, indicating its regional importance for biodiversity. So far 22 Important Bird Areas (IBAs) have been provisionally identified on the archipelago by BirdLife specialists, but this number is likely to increase with extended surveys (EVANS 1994) (Fig. 34).

The local people distinguish a number of birds by special names, and they have almost a personal relationship toward some of them. They honour the small nocturnal owl *Scops socotranus* GRANT & FORBES, 1899, because its call sounds to them like a prayer (Fig. 37). Whereas they despise the Brown-necked Raven (*Corvus ruficollis* LESSON, 1830-1831), hitherto the only Socotran Corvidae, not only because of its occasional attacks of young livestock, but also by its negative role of the „rasping“ bird in the traditions of the prophet Mohammed.

Bird trapping for food seems to be fairly common (Fig. 40). The most attractive species on Socotra are pigeons, starlings and sparrows, while the people on Samha and Abd al Kuri focus their attention apparently exclusively on sea birds. Different types of net- or cage-like traps are in use, also lime-sticks, prepared with the adhesive resin of *Euphorbia socotrana* BALF.f. (a large glabrous shrub or small tree with reddish brown stems and dark green leaves).

The land tortoises, crocodiles and giant lizards referred to by the author of the "Periplus" have not been found so far, but this is not to say that they did not exist. It might be that the fauna of Socotra has changed substantially in some groups over the past at least 2000 years of human activities. In this connection various reasons for an extinction of larger reptiles and other forms are conceivable. There may have been natural factors, such as climatic changes. But there were undoubtedly also drastic effects to the vegetation, grazing impacts and habitat degradation, since the various types of stock have been introduced. Another aspect could be the pressure by predators, such as the introduced Civet Cat or feral cats. The larger reptiles may also have been hunted directly by the people, either for food, trade, or because they were dangerous. BOULENGER (1903) mentioned a widespread belief in some parts of Asia in the efficacy of reptile fat when rubbed over the body as a curative remedy for all sorts of illness. So it might be that a Socotra *Varanus* or a huge skink became extinct due to the fact of being used as food and medicine in an environment where both were scarce. At present there is no use of lizards and snakes for such a purpose by the local people.

The large land tortoise was possibly a form like the Aldabra tortoise (*Megalochelys gigantea* (SCHWEIGGER, 1812)) from the Seychelles, either endemic or introduced by sailors in the past. Another possible candidate or relative could be the leopard tortoise (*Geochelone*), which is found throughout eastern Africa. If there were crocodiles on Socotra in the past, neither the Nile crocodile (*Crocodylus niloticus* LAURENTI, 1768) nor *Crocodylus porosus* SCHNEIDER, 1801 can be excluded. However, it is still unknown which larger reptile species, if any, have lived on the island, so that any discussion about the causes for their extinction is speculative. They are not mentioned in local legends and stories, so that a more detailed answer can be given only by searching for fossil remains. Suitable areas for such excavations would be the cave sediments.

Apart from the possible loss of inhabitants, Socotra still has a rich and interesting reptilian fauna. Some 27 terrestrial species have been reported from the archipelago, about 24 of them are considered to be endemic.

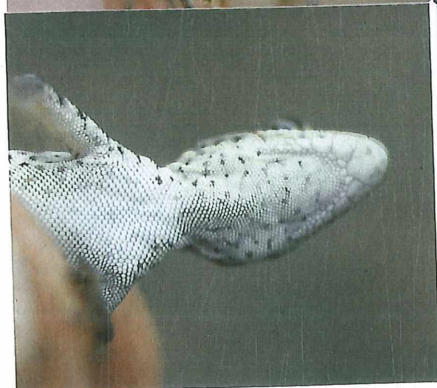
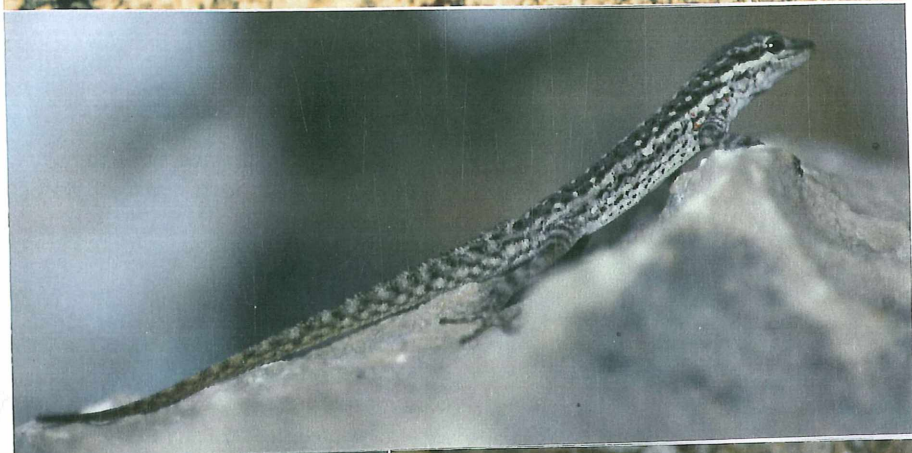


Fig. 41 Reptiles (previous page / vorige Seite):

While most geckoes are nocturnal and communicate by vocalisation, the semaphore forms are active in the heat of the day and signal each other by waving their tails, straightening the body or swelling the throat.

The Socotran semaphore geckoes can be divided into the *Pristurus sokotranus* group, with *P. sokotranus*, *P. abdalkuri*, *P. guichardi*, *P. obsti*, *P. samhaensis* (all share a number of external features, such as body shape, lateral markings on the neck and shoulder region and a more or less distinct dorsal tail crest) and the *P. insignis* - group with *P. insignis* and *P. insignoides* (both more slender built and without a crest of enlarged scales on the tail).

Pristurus sokotranus PARKER, 1938

It is a diurnal, climbing species, widespread and common from the plain up to the mountains on Socotra. Specimens (total length around 100 mm) are generally found among the larger rocks or on boulders in the dry beds of water courses, where they may be frequently seen sunning themselves. However they are constantly on the alert for danger and swift in their movements.

Their colour is highly variable, from greyish to brown. Characteristic are a light median stripe from the occiput to the base of the tail and a light lateral stripe from beneath the eye above the fore limb to the groin. However these stripes can be also changed in a series of spots. A distinct character is also dark throat dots. The tail is strongly compressed, with a median crest dorsally composed of lanceolate scales.

P. sokotranus females lay a single egg. It is deposited in the ground or beneath stones.

Known only from Socotra.

Fig. 42 Reptiles (next page / nächste Seite):*Pristurus abdalkuri* ARNOLD, 1986

This semaphore gecko resembles *P. sokotranus* in its morphological characters, but it does not show its characteristic stripes. The specimens are pale grey with a brownish tinge: There are rows of pale spots along the upper neck and flank, always alternating with dark longitudinal streaks, but the colouring is rather variable. Another distinct character is, that the scales of the ear opening are not homogenous as in *P. sokotranus*, but unequal, e.g. there is a group of enlarged scales above the ear opening.

Pristurus abdalkuri was supposed to be restricted to Abd al Kuri, where it lives from the plain to the mountains. In 1997 it was also recorded on Socotra by Rösler & Wranik. However here the species seems to be restricted to suitable rocky habitats along the edge of the sea.

Known from Socotra and Abd al Kuri.

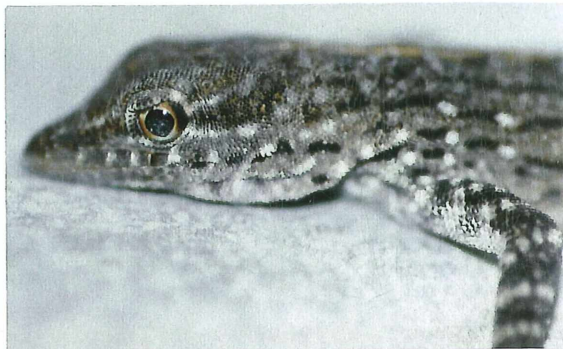
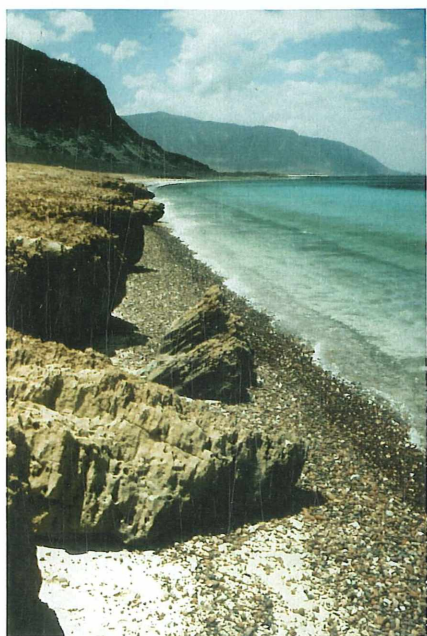
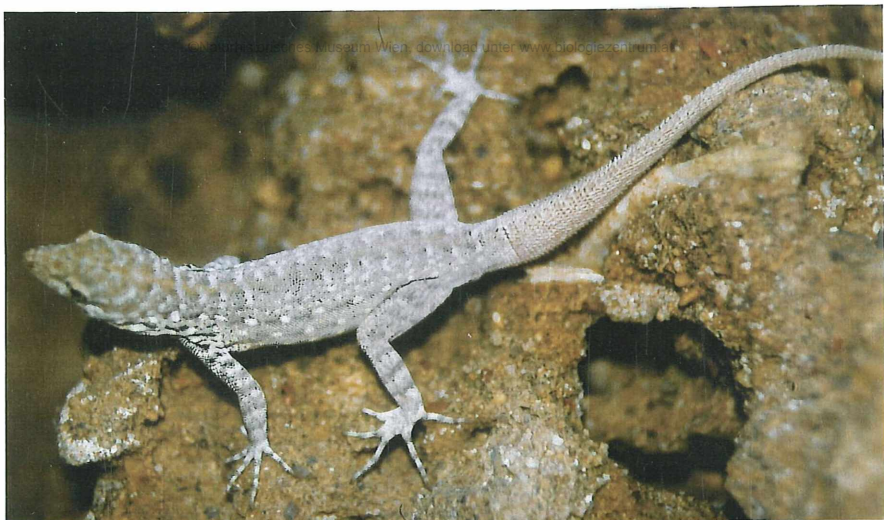
Above: *Pristurus abdalkuri* (Abd al Kuri).

Second row: *Pristurus abdalkuri* (Abd al Kuri).

Third row right: *Pristurus abdalkuri* (Abd al Kuri).

Below left: Habitat of *Pristurus abdalkuri* on Socotra (near Hawlaf).

Below right: *Pristurus abdalkuri* (Hawlaf).



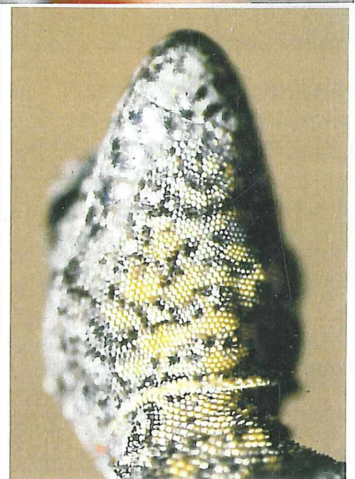
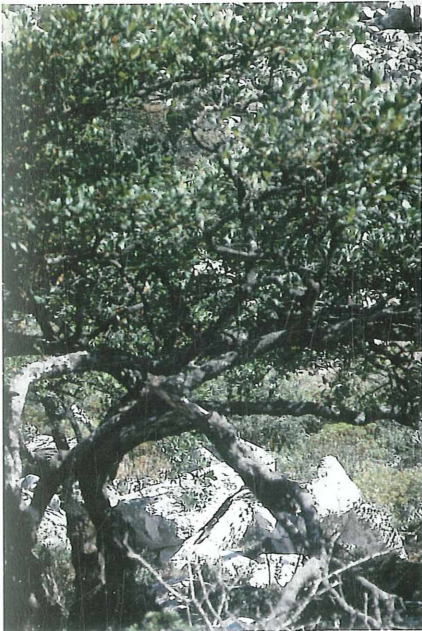


Fig. 43 Reptiles (previous page / vorige Seite):

Pristurus guichardi ARNOLD, 1986

Little is known about this semaphore gecko, which shares a number of external features with *P. sokotranus*. However it differs in some characters, such as the size of scales or also in colouring. *Pristurus guichardi* has no light dorsal stripes, but dark transverse markings on head and neck. The flanks are with traces of dark, broken longitudinal streaks and a number of small, light spots.

We made all our records on trees in the mountains, where the well camouflaged, climbing specimens were sitting in the shade. When disturbed, they usually dodged around the trunk rapidly or tried to flee upwards among more spiny branches.

Known only from Socotra.

Photos: *Pristurus guichardi*, Firmihin.

Bottom left: Habitat of *Pristurus guichardi*.

More than half of the reptile species are geckoes. Widespread and abundant among larger rocks and boulders are the semaphore *Pristurus*, with at least 7 different species on the archipelago, all endemic (Figs. 41-47). They are diurnal, signal to each other by waving the tail up and down and swelling the throat. Their toes are hooked, and like all geckoes they have a delicate skin with small granular scales. However, the difficulty in distinguishing swift moving animals in the field means, it is problematic at present to assess the status and distribution of the different species. On Socotra the most widespread and common species from the coastal plain up to the mountains, is *P. sokotranus* PARKER, 1938. *Pristurus abdelkuri* ARNOLD, 1986 was supposed to be restricted to Abd al Kuri, where it occurs all around the island, but in 1997 we found it along a rocky shore near Hadibo and in the village itself. On Socotra it seems to occur only in suitable coastal habitats. In contrast to these two forms, which usually are active in sun exposed places, *P. guichardi* ARNOLD, 1986 seems to prefer the shady sides of trees, where their dark colour guarantees camouflage on the bark. Of the new species recorded during the 1999 expedition one is *Pristurus samhaensis* RÖSLER & WRANIK, 1999 living on Samha, while *Pristurus obsti* RÖSLER & WRANIK, 1999 was found in mangrove on Socotra. Because the latter seems to be adapted exclusively to a mangrove habitat, it must be considered as endangered like the habitat.

The remaining two species (*P. insignis* BLANFORD, 1881, *P. insignoides* ARNOLD, 1986) are larger and were mostly recorded on exposed rocky places in the mountains.

Fig. 44 Reptiles (next page / nächste Seite):

Pristurus obsti RÖSLER & WRANIK, 1999

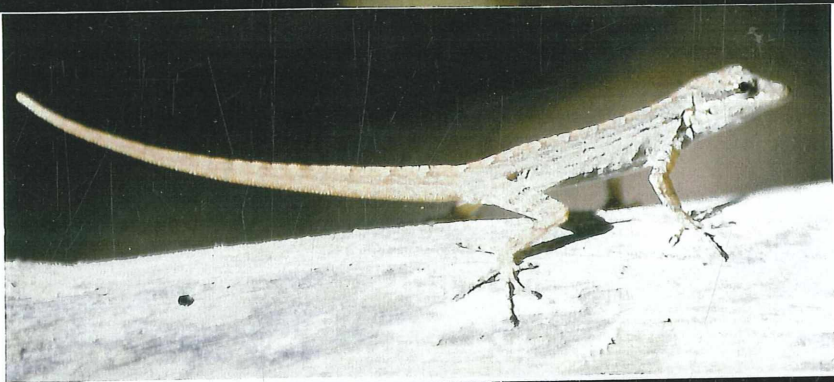
The species was discovered in March 1999 in a mangrove near Ras Shoab. It is a gracefully built, brownish coloured semaphore gecko, with narrow longitudinal rows at the flanks. Lateral spots are missing. The specimens were restricted to the interior, shady part of the mangrove and were sitting on the trunk or branches of mangrove trees. Their escape behaviour is similar to that of *P. guichardi*, e.g. if disturbed they usually do not descend to the ground, but run up and down the trunk and into the branches. In response to conspecifics and observers, as in the other relatives, the tail and the body may be moved up and down.

If the species is really restricted to mangroves, it must be considered endangered, as the habitat.

Known only from Socotra.

Photos: *Pristurus obsti* in a mangrove near Ras Shoab.

Bottom left: Habitat of *Pristurus obsti*.



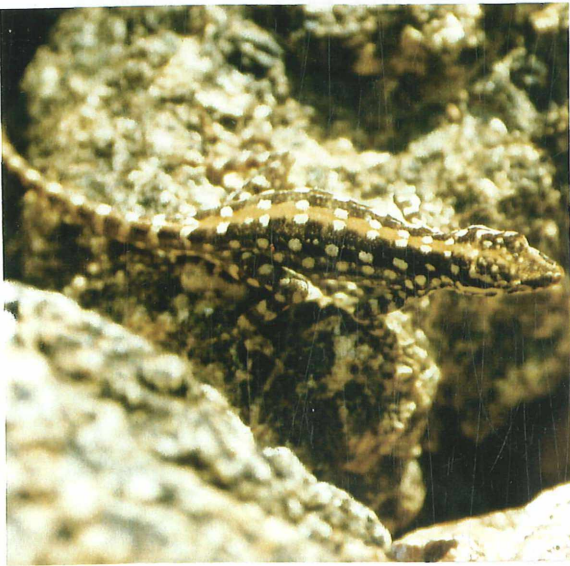
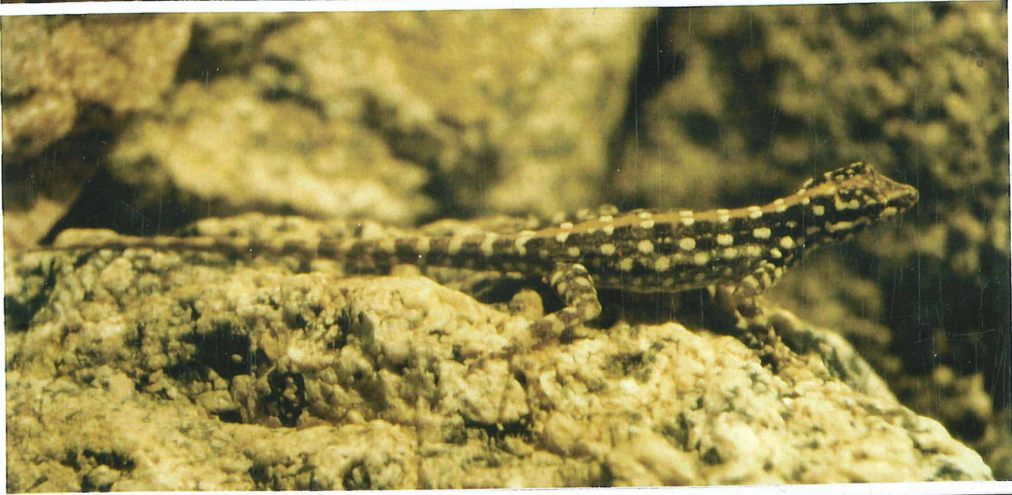


Fig. 45 Reptiles:
Pristurus samhaensis RÖSLER & WRANIK, 1999: This medium-sized semaphore gecko was discovered on Samha in 1999. It was found among rocks from the plain up to 250 m. A typical character are distinct dorsal and lateral spots. Known only from Samha.

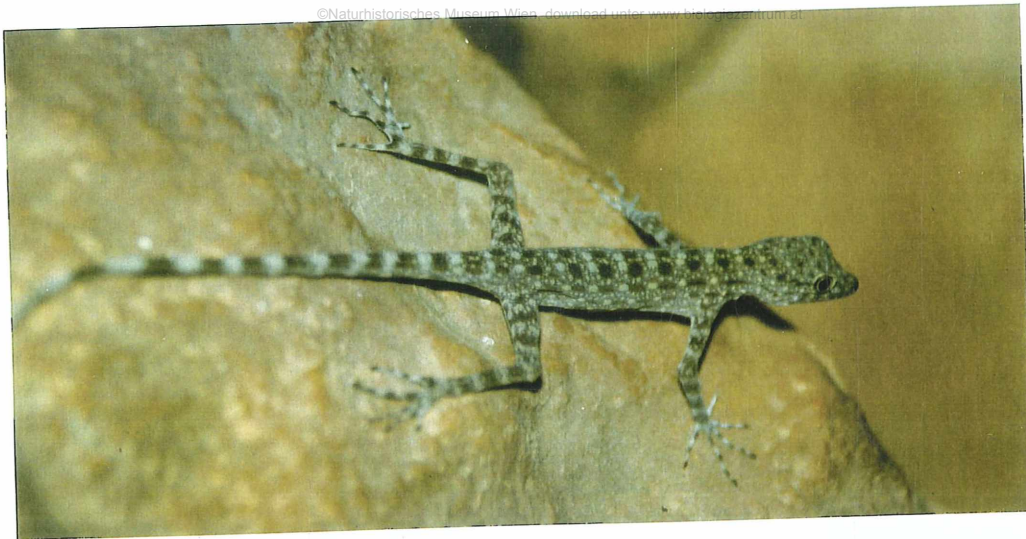


Fig. 46 Reptiles: *Pristurus insignis* BLANFORD, 1881: This diurnal gecko is generally considered a montane species. Records are from an altitude of 200 to 700 m. The specimens, which are slender (total length up to 160 mm), long-legged and actively foraging, are generally found on the perpendicular face of larger rocks and cliffs, where they use cracks and fissure to escape. It seems, that *P. insignis* avoids a direct exposure to the sun. Known only from Socotra. - Photos: *Pristurus insignis*, Diksam. - **Bottom left:** Habitat of *Pristurus insignis*.

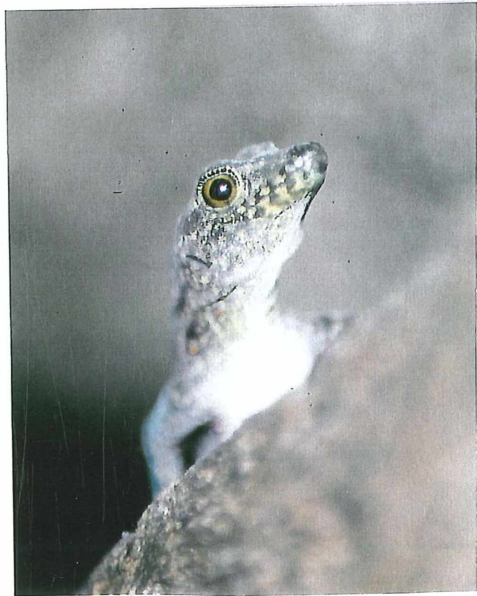
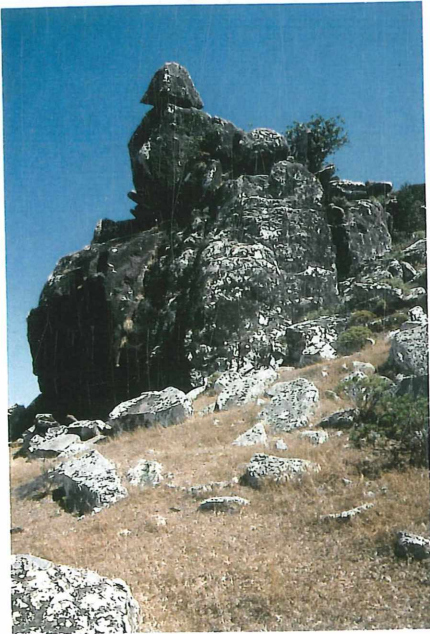
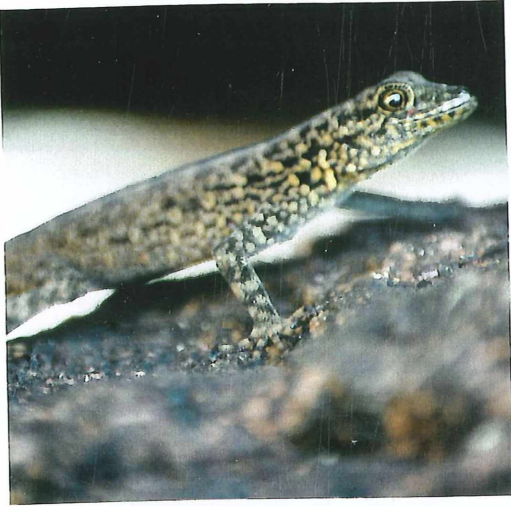


Fig. 47 Reptiles (previous page / vorige Seite):

Pristurus insignoides ARNOLD, 1986

It is similar in size, shape and habits to *P. insignis*. However it seems to be restricted to the highland areas. Records are from altitudes of 1000 to 1350 m. It differs from *Pristurus insignis* in a rather more depressed head and body, a blunter snout, larger ear openings and rather coarser body scales. The throat is mottled rather than coarsely reticulated.

Known only from Socotra.

Photos: *Pristurus insignoides*, Firmihin.

Bottom left: Habitat of *Pristurus insignoides*.

Eight species belong to the nocturnal genus *Hemidactylus*. They have flattened adhesive pads located on all the digits of the feet (Fig. 48 - 54). *H. flaviviridis* RÜPPEL, 1835 is common on the walls of those houses in Hadibo, where lamps provide light for a few hours in the evening. It forms the group of non-endemic reptiles with *H. turcicus* (LINNAEUS, 1758) and *H. homeolepis* BLANFORD, 1881 - the latter was also recorded from Samha and Abd al Kuri. The small *H. pumilio* BOULENGER, 1903 and the large *H. granti* BOULENGER, 1899 apparently prefer the mountainous region of Socotra, while *H. oxyrhinus* BOULENGER, 1899 and *H. forbesii* BOULENGER, 1899 seem to be restricted to Abd al Kuri. *H. forbesii* shows an interesting behavioural peculiarity: in case of danger, specimens sitting on rocks along the coast try to escape by jumping in the sea (JÖGER, pers. inform.). A new species (*Hemidactylus dracaenacolus* RÖSLER & WRANIK, 1999) was recorded in 1999 on the Diksam plateau on Socotra Island.

Haemodracon riebeckii PETERS, 1882, with a total length of almost 300 mm, is the largest known leaf-toed gecko, which can be easily recognized by their digits, which bear a single pair of enlarged terminal scansors (Fig. 55). The species was discovered by Riebeck, who recorded three specimens (PETERS 1882). These nocturnal „giants“ apparently prefer holes in older trees or among rocks. In 1999 a *Haemodracon* was also caught on Samha for the first time, and it could be a further new species (JÖGER, pers. inform.). The description of *P. trachyrhinus* BOULENGER, 1899, whose largest known total length is only 95 mm, was based on two specimens recorded by Ogilvie-Grant & Forbes at Jena-agahan (365-760 m) and Adho Dimellus (1066-1370 m) (BOULENGER 1903). This smaller relative seems to be relatively rare. We collected it only twice, the first on the Diksam plateau at an altitude of about 900 m, and the second on the mountain slopes not far away from Hadibo. Both habitats were stony with sparse vegetation (Fig. 56).

Mesalina balfouri BLANFORD, 1881 is the only species of Lacertid lizard (Figs. 57-58). It has been recorded from Socotra, Abd al Kuri and Samha. Clearing up the state of these populations, which show slight differences, will be an issue of further research. The lizard is diurnal in habit and fairly common on sand, gravel and stony substrates from sea level to the hill side.

Fig. 48 Reptiles (next page / nächste Seite):

Hemidactylus flaviviridis RÜPPEL, 1835

The Yellow-bellied House Gecko is one of the few non-endemic reptiles. It is common on house walls in Hadibo.

Widespread, occurring in North Africa and eastwards through Arabia to eastern India. Recorded on Socotra only.

Photos: *Hemidactylus flaviviridis*, Hadibo.

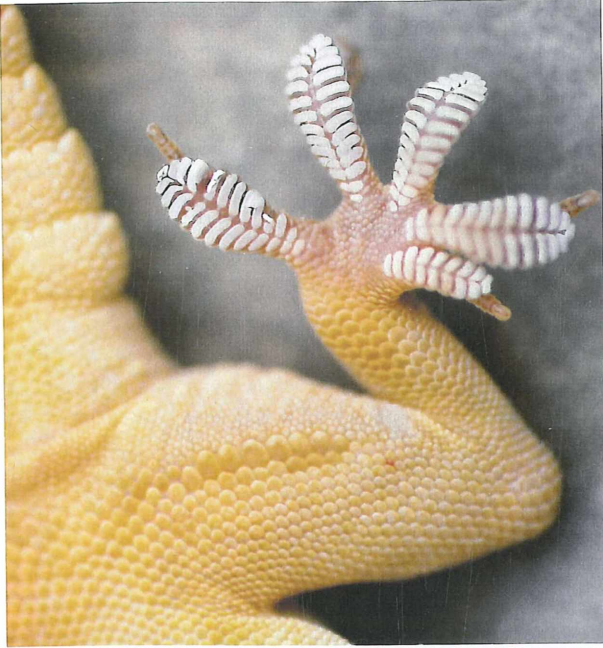




Fig. 49 Reptiles (previous page / vorige Seite):

Hemidactylus turcicus (LINNAEUS, 1758)

It is a common nocturnal gecko, mostly found on the walls of buildings.

Non-endemic, occurring in North Africa and eastwards through Arabia to Pakistan. Recorded on Socotra only.

Top & middle: *Hemidactylus turcicus*, Hadibo area.

Bottom: *Hemidactylus* cf. *turcicus*. The photo, taken by Rösler, shows a specimen which is unusual in size (about 150 mm) and habit, because it was recorded on the trunk of a dragon's blood tree at Diksam (altitude of about 700 m). Its status needs further studies.

Fig. 50 Reptiles (next page / nächste Seite):

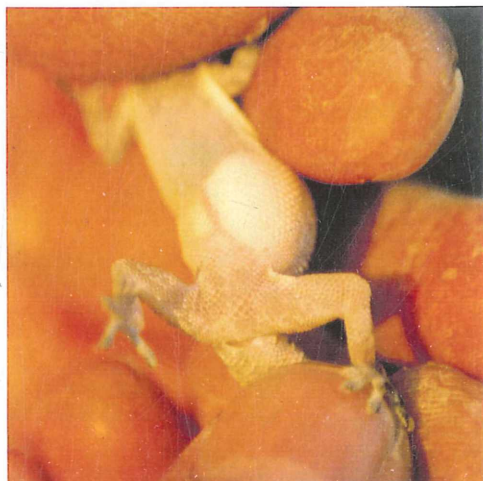
Hemidactylus homoeolepis BLANFORD, 1881

It is a fairly common nocturnal gecko (total length about 80 mm) from the plain up to the mountains, which can be found during the day under stones or pieces of wood. Non-endemic, also known from the Arabian mainland.

Recorded from Socotra, Samha and Abd al Kuri.

Photos: *Hemidactylus homoeolepis*, Hadibo area.

Bottom right: Female *Hemidactylus homoeolepis* with egg.



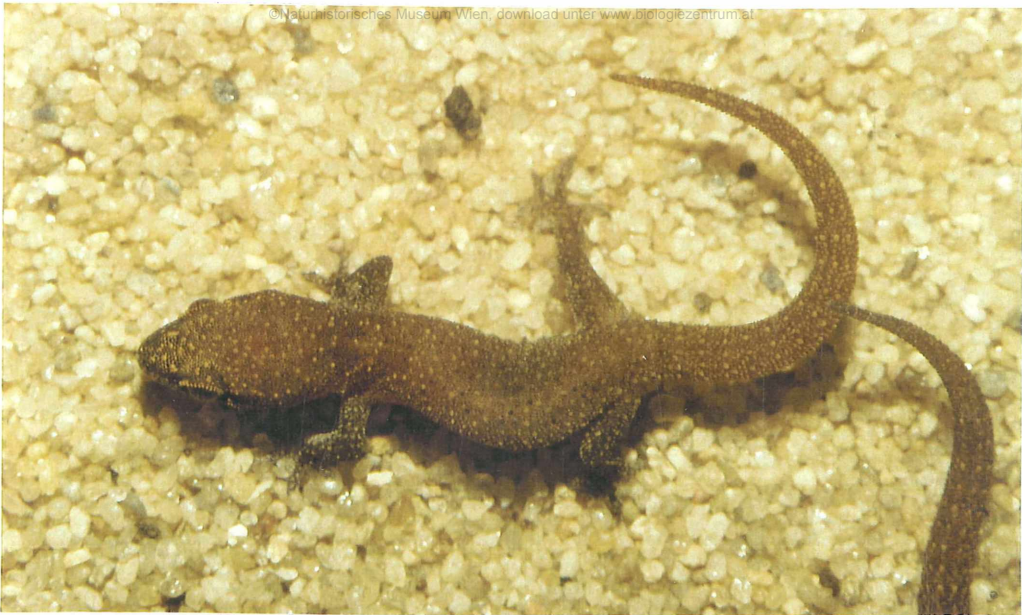


Fig. 51 Reptiles (previous page / vorige Seite):

Hemidactylus pumilio BOULENGER, 1903

With a total length of about 50 mm this endemic nocturnal gecko is one of the smallest known *Hemidactylus*-species. The specimens collected were usually found under boulders and stones in or near the dry bed of streams.

Known only from Socotra.

Photos: *Hemidactylus pumilio* recorded at the mountain slope southeast of Hadibo at an altitude of 110m.

Fig. 52 Reptiles (next page / nächste Seite):

Hemidactylus granti BOULENGER, 1899

It seems to be a highland species (total length about 170 mm). Most records are from the hill side under stones.

Known only from Socotra.

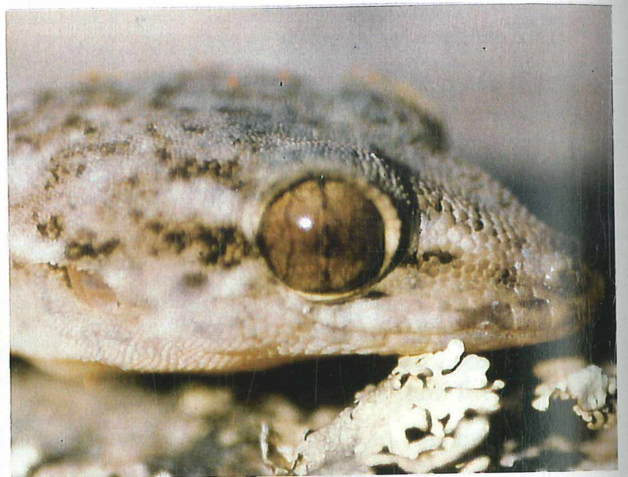
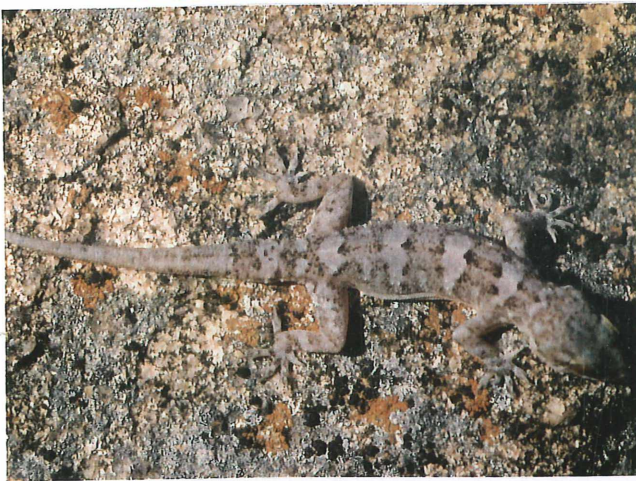
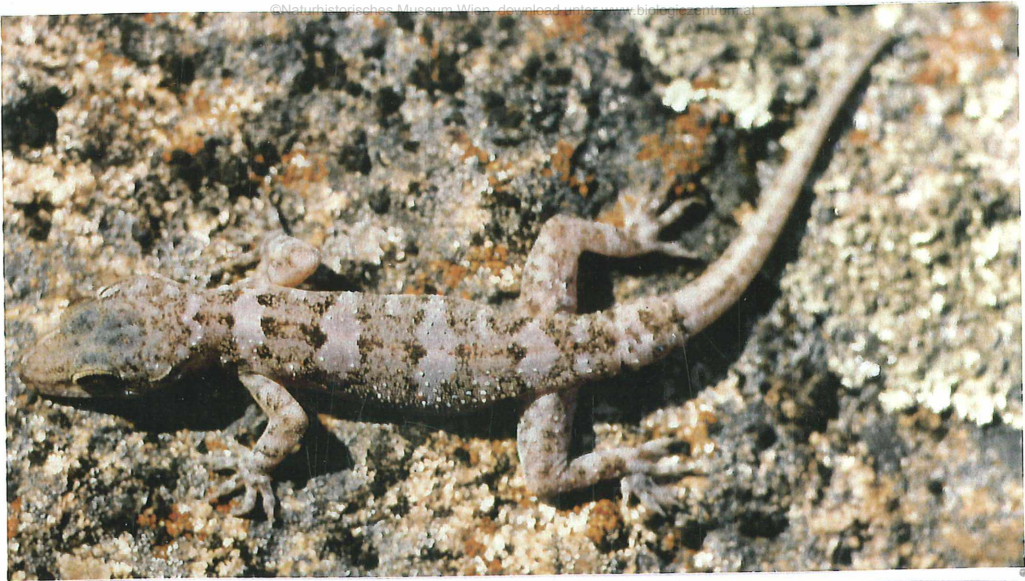
Top & middle: *Hemidactylus granti*, Firmihin.

Hemidactylus dracaenacolus RÖSLER & WRANIK, 1999

The species was discovered in 1999. It is a medium-sized (total length about 120 mm), greyish brown coloured nocturnal gecko, with very small dorsal tubercles, which are arranged in regular longitudinal rows. Two specimens were found on dragon's blood trees at Diksam (altitude of about 700 m).

Known only from Socotra.

Bottom: *Hemidactylus dracaenacolus*, Diksam (photo Rösler).



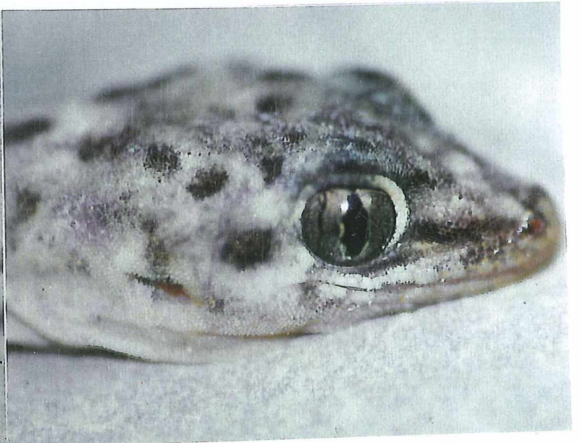
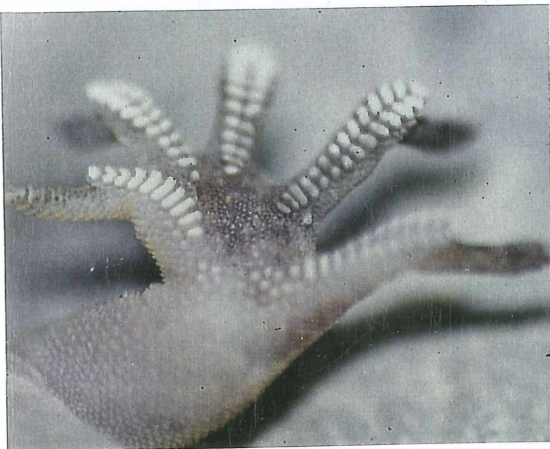


Fig. 53 Reptiles (previous page / vorige Seite):

Hemidactylus forbesii BOULENGER, 1899

A larger, nocturnal species with a total length of almost 200 mm. We found it under stones in the surrounding of our camp side at Abd al Kuri in the coastal plain in March 1999.

Known only from Abd al Kuri.

Fig. 54 Reptiles (next page / nächste Seite):

Hemidactylus oxyrinus BOULENGER, 1899

Smaller in size than *H. forbesii* (total length about 95 mm) and characterized by large tubercles on the back. Specimens were found under stones.

Known only from Abd al Kuri.

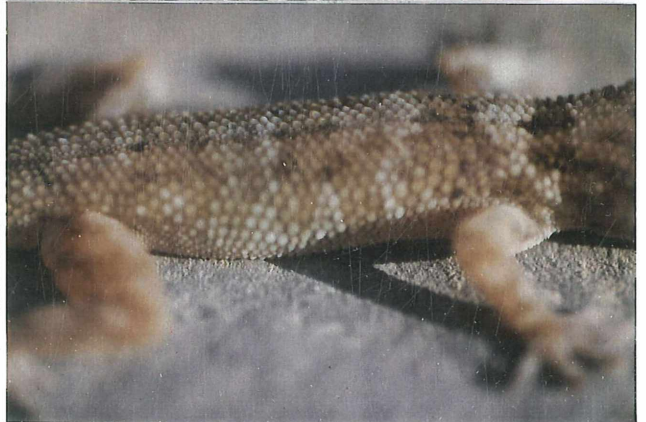
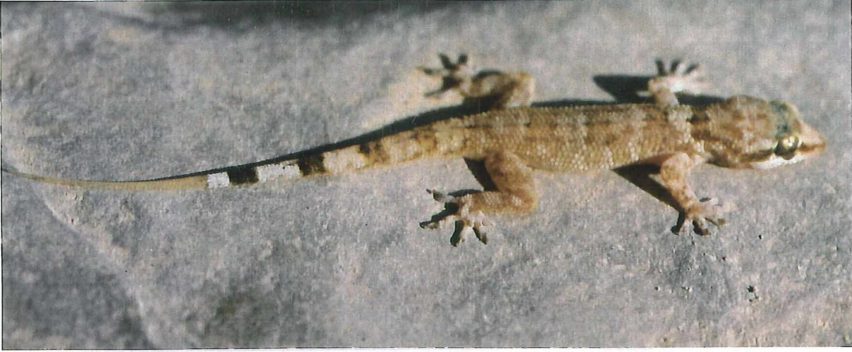
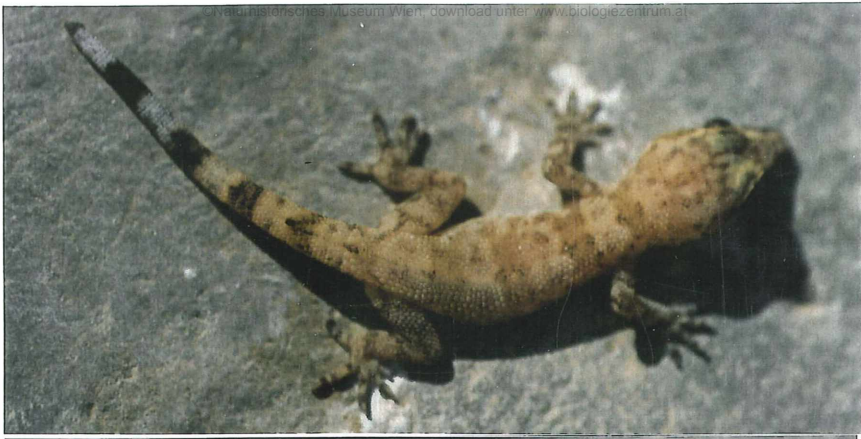


Fig. 55 Reptiles (next page / nächste Seite):

***Haemodracon riebeckii* (PETERS, 1882)**

This nocturnal „giant“ is with a total length of almost 300 mm the largest known leaf-toed gecko. Most records on Socotra are from higher altitudes. The specimens were found in holes of larger trees and in caves, but a few also under larger stones. However there was also an observation at an altitude of about 200 m east of Hadibo. The specimens on Samha need further studies to clarify their status.

Top: A couple of *H. riebeckii* near the entrance of a hole in a dragon's blood tree *Dracaena cinnabari* at Diksam and leaf-toed foot pads.

Middle left: The male specimen.

Middle right: Head of a *Haemodracon riebeckii*.

Bottom left: *Haemodracon riebeckii*, Diksam.

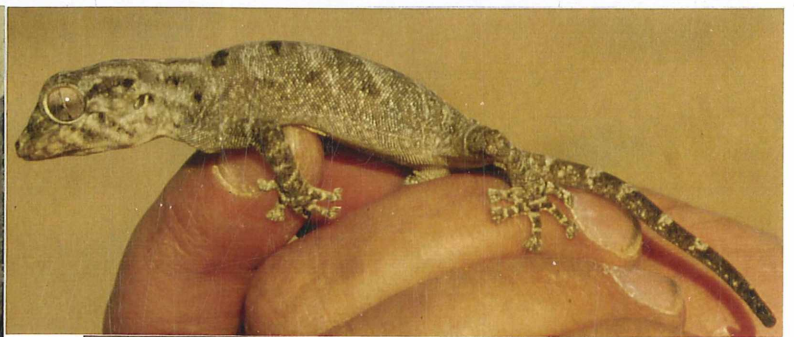
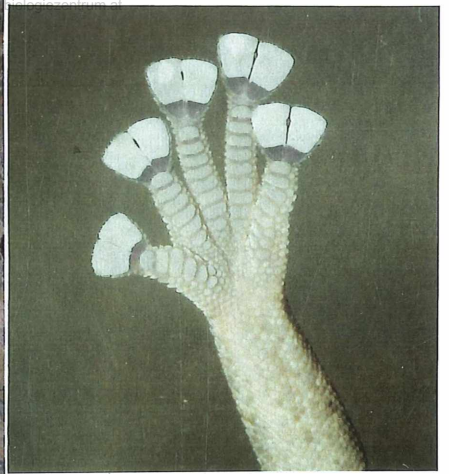
Bottom right: Two photos of the *Haemodracon* recorded on Samha by Joger in March 1999.

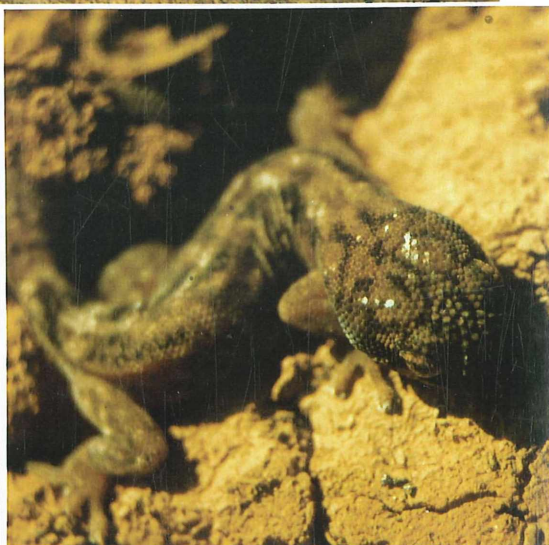
Fig. 56 Reptiles (page 156 / Seite 156):

***Haemodracon trachyrhinus* (BOULENGER, 1899)**

Little is known about this endemic leaf-toed gecko (total length up to 95 mm). Only four specimens have been recorded so far. Three records are from the mountains, one from an altitude of about 200 m east of Hadibo. The photos show a female specimen which was found under a stone at Diksam.

Known only from Socotra.





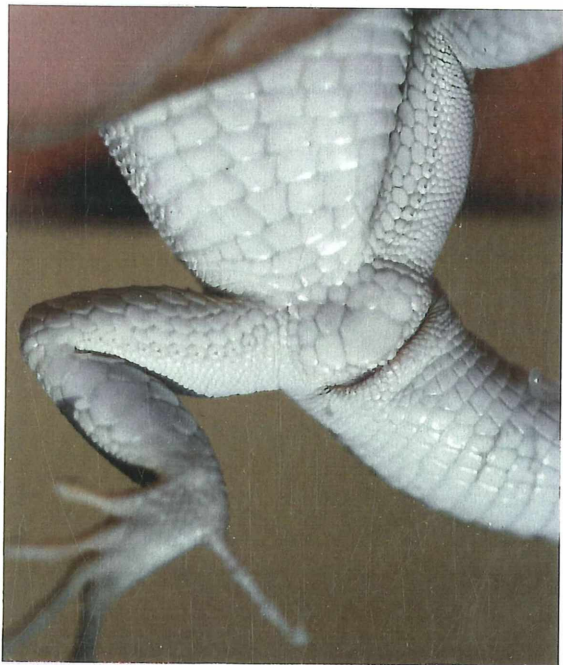


Fig. 57 Reptiles (previous page / vorige Seite):

Mesalina balfouri BLANFORD, 1881

The brownish Lacertidae is common from sea level up to the mountains. It is found on stony areas, generally seen basking on the ground.

Top: *Mesalina balfouri*, Hadibo.

Middle left: A couple of *Mesalina balfouri*, Hadibo.

Middle & bottom right: Femorale pores in female (above) and male (below).

Bottom left: Head of *Mesalina balfouri*, Hadibo.

Fig. 58 Reptiles (next page / nächste Seite):

Mesalina balfouri BLANFORD, 1881

The species was recorded from Socotra, Samha and Abd al Kuri. The populations on Samha and Abd al Kuri need further studies to clarify their status.

Photos: *Mesalina balfouri*, Abd al Kuri.

Bottom left: Head of *Mesalina balfouri*, Samha.

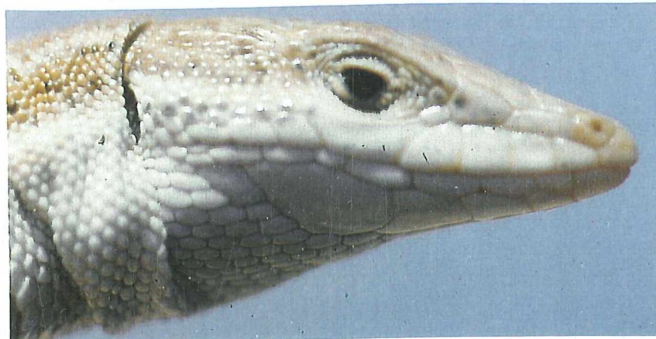
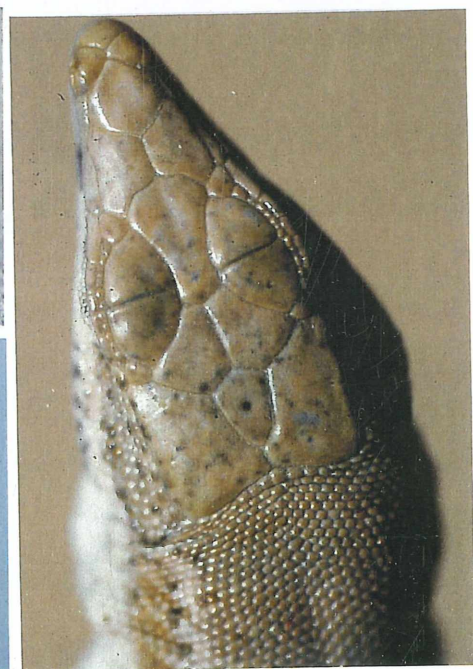
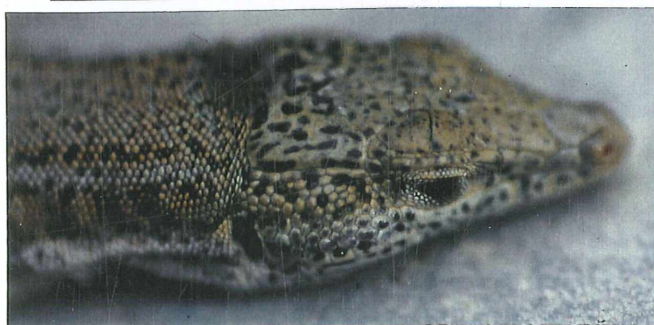


Fig. 59 Reptiles (next page / nächste Seite):

***Mabuya socotrana* (PETERS, 1882)**

It is the larger (total length up to 220 mm) of the two skink species known from the Archipelago, both endemic. The adult specimens are olive in colour, with the head rufous brown, while young forms are black above, with white longitudinal lines and a bluish tail.

M. socotrana is widespread and fairly common from the plain up to the mountains. It is diurnal and can be found on stony plains and rocky areas, but also in the vicinity of villages and houses.

The species is known from Socotra, Samha and Abd al Kuri.

Photos: *Mabuya socotrana*, Hadibo.

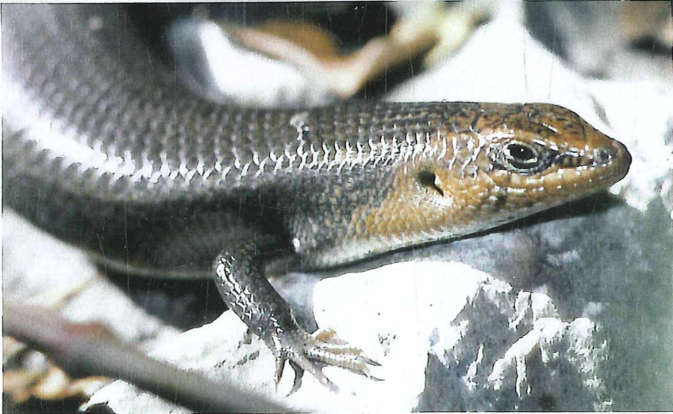
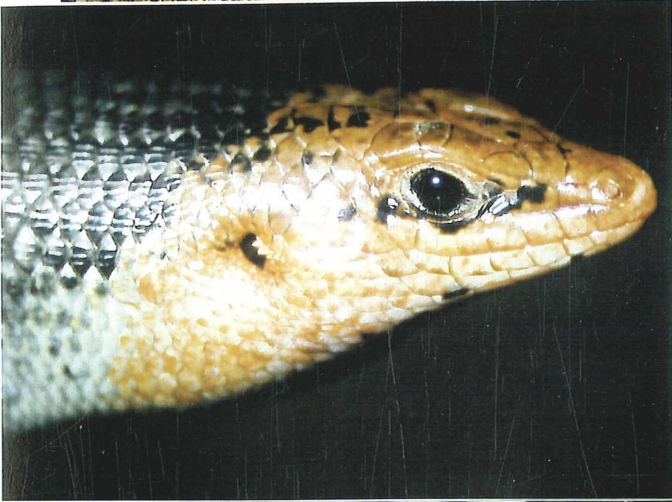
Fig. 60 Reptiles (page 162 / Seite 162):

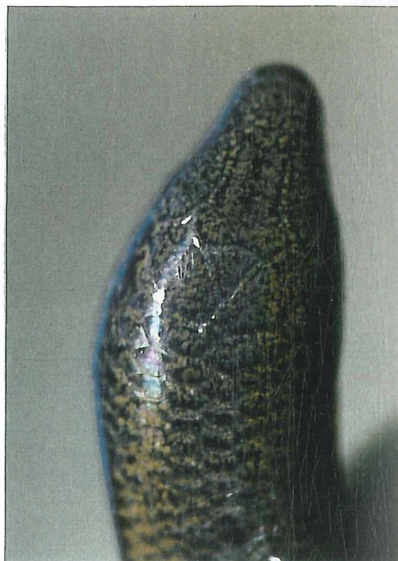
***Parachalcides socotranus* BOULENGER, 1899**

The body of this skink is much elongate (total length up to 118 mm), and the limbs are short. It is reddish brown above, each scale with a black spot. *P. socotranus* is supposed to be nocturnal. All known records are from the mountains.

Known only from Socotra.

Photos: *Parachalcides socotranus*, Firmihin.





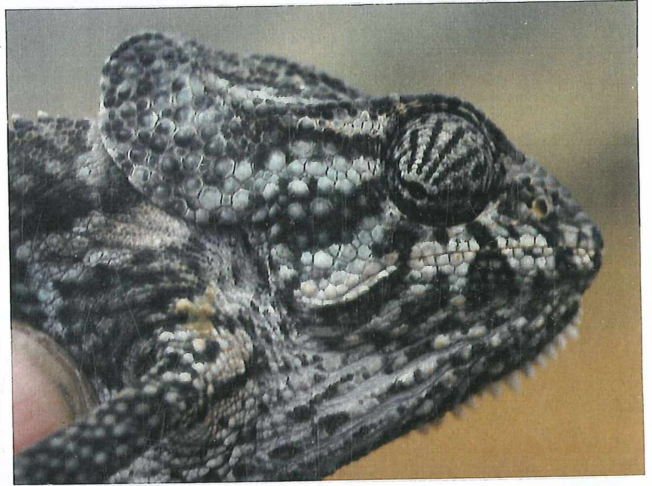
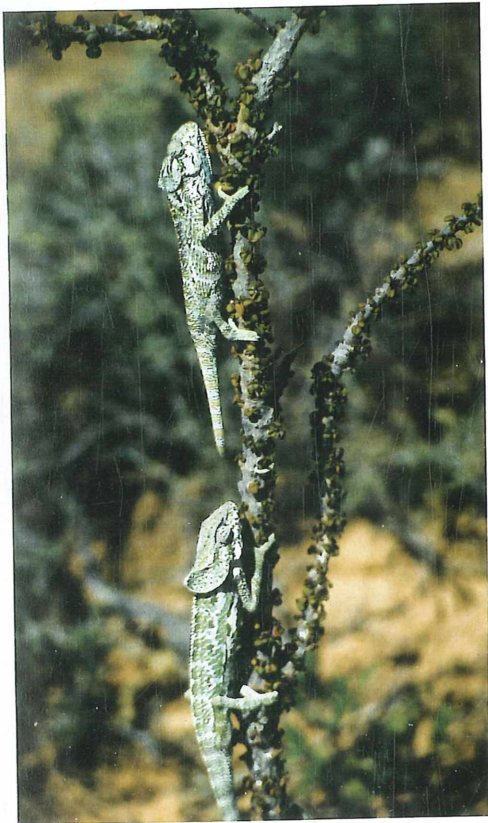
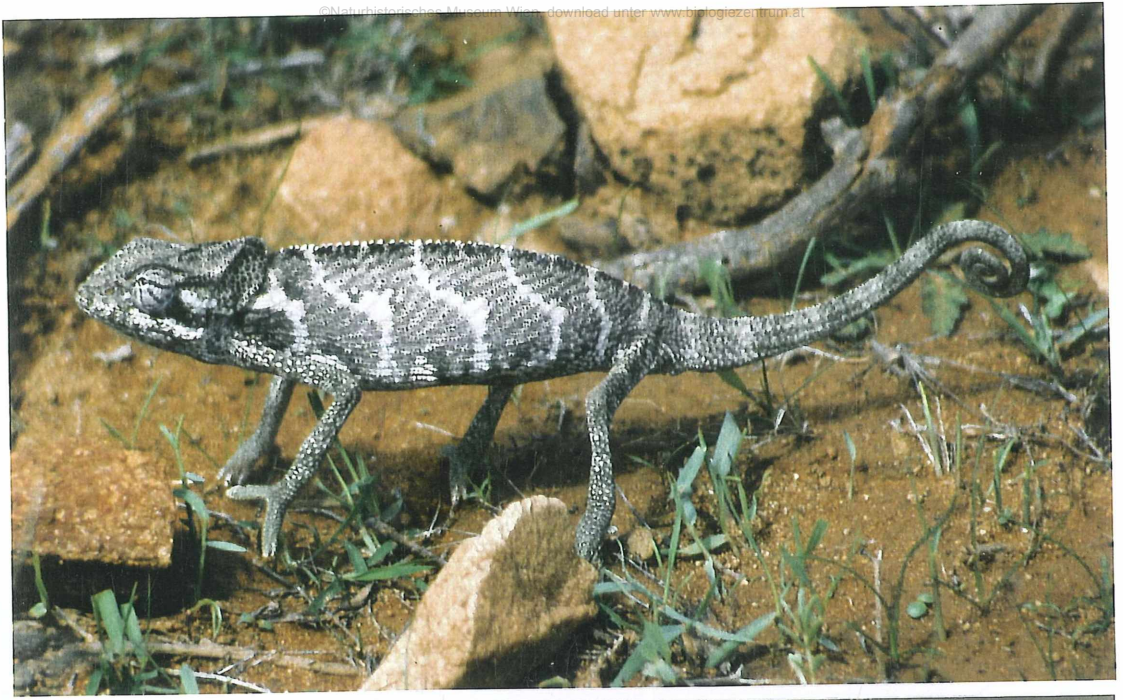


Fig. 61 Reptiles (previous page / vorige Seite):

Chamaeleo monachus GRAY, 1864

The endemic chameleon (total length up to 352 mm) seems to be widespread on Socotra. Records are from the coastal plain up to the mountains. It can be seen walking slowly and sedately about among the branches of bushes or on the ground.

Known only from Socotra.

Photos: *Chamaeleo monachus*, Haghier mountains.

Bottom left: A couple of *Chamaeleo monachus*, Noked plain.

Fig. 62 Reptiles (next page / nächste Seite):

Pachycalamus brevis GÜNTHER, 1881

Little is known about this strange looking reptile. Its worm-like body has a diameter of about 9 mm and a total length of about 210 mm. It is brown or dark purplish above, with the head and lower surfaces yellowish white. There are 180 to 193 annuli on the body. The head is depressed, with a truncate projecting snout, the eyes are slightly distinct through the ocular.

Known only from Socotra.

Above: *Pachycalamus brevis*, Hadibo (photo Rösler).

Right side: Head shields *Pachycalamus brevis*.

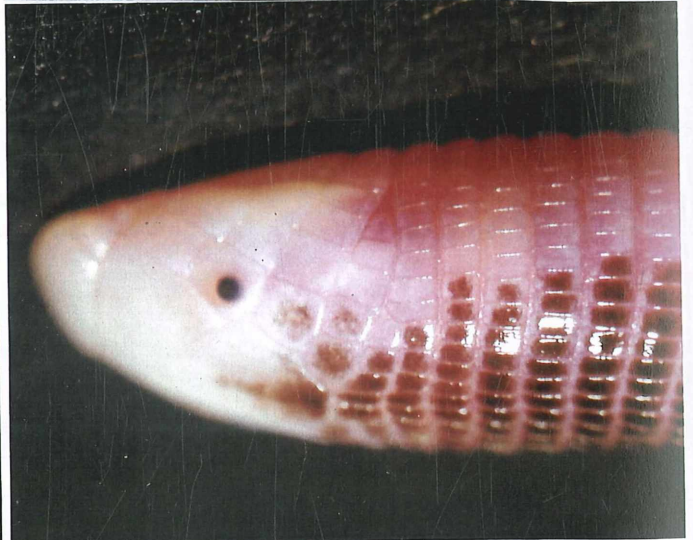


Fig. 63 Reptiles (next page / nächste Seite):

There are three worm-like snake species, all endemic and only known from Socotra.

Typhlops socotranus BOULENGER, 1893

Only a few specimens of this worm-like snake have been recorded so far. The living specimens are yellowish in colour, with reddish to brown lines running between the dorsal series of scales. The diameter of the body is 31 to 50 times the total length (up to 260 mm). The tail is as long as broad, ending in a spine.

Top: *Typhlops socotranus* obtained in March 1999 in Hasaant from below a stone (photo Rösler).

Leptotyphlops cf. filiformis (BOULENGER, 1899)

We met with forms of *Leptotyphlops* in Firmihin and Hasaant. The flesh-coloured, swift moving specimens were found under stones, where they live in holes in the ground. They can be easily distinguished from *Typhlops* by the arrangement of the head shields, while the two *Leptotyphlops* forms are quite similar in their characters, in range and habits, and therefore more difficult to distinguish in the field. *Glauconia filiformis* differs from *G. macrura* (BOULENGER, 1903) in a more pointed snout, and in the rostral shield not extending so far back as the level of the eyes. Its diameter of body is 100 to 140 times the total length (up to 155 mm), while in *G. macrura* it is 40 to 48 times the total length (up to 170 mm).

Bottom: *Leptotyphlops cf. filiformis*, Hasaant.

The two endemic skink species are characterized by the typical body shape of the group, i.e. a shovel-like head, smooth scales and reduced limbs (Figs. 59-60). The larger *Mabuya socotrana* (PETERS 1882) (up to 218 mm), known from Socotra, Samha and Abd al Kuri, seems to be diurnal (WRANIK 1998). It is common and widespread on stony plains, among rocks and boulders, but also in the vicinity of villages and houses, from the coastal plain to the mountains. The more slender *Parachalcides socotranus* BOULENGER, 1899 (up to 118 mm), so far recorded from Socotra only, is supposed to be nocturnal and more restricted to the mountains.

The endemic *Chamaeleo monachus* was described by GRAY (1864), but the type specimen in the Museum of Natural History in London is labelled „Madagascar“ (WRANIK 1998). The question whether this is a label error, or if a chameleon, which lives well in captivity, was brought alive from one African island to another, as supposed by BLANFORD (1881), has not been answered yet. SHOWLER (1996) supposes that the species might be restricted to lush areas with good vegetation cover with at least some patches of soft substrate, suitable for egg-laying. Widespread among the mountain dwellers is the belief, that a man can lose his voice if he is close to the hissing sound of a chameleon (Fig. 61).

The strange looking *Pachycalamus brevis* GÜNTHER, 1881 seems to be fairly common on Socotra, although specimens have rarely been seen because of their burrowing lifestyle (WRANIK 1998) (Fig. 62). The body of this legless lizard is covered in ring-like scales giving it an appearance of an earthworm. It belongs to the Trogonophidae or Amphisbaenians. The latter name deriving from the Greek for „going in both ways“. This mistaken idea arose because ancient people thought it had two heads, an impression which is caused by the minute eyes covered by transparent scales and the ability, to wave the tail in the same way as a snake waves its head. We found the species under stones beside a dry wadi bed in the vicinity of Hadibo. *P. brevis*, among other Socotran endemics, is considered by JOGER (1985) to be a relic of an ancient and now widely extinct Afroarabian herpetofauna.

The snakes are represented by five endemic species (Figs. 63-65). Three belong to the worm-like *Typhlopidae* and *Leptotyphlopidae* (WRANIK 1998). Little is known about their distribution, because they are also, similar to *P. brevis*, living in holes in the ground, usually below stones. Not surprisingly for this life underground, the eyes are vestigial (Blind-Snakes) and are only able to discern differences in light intensity.

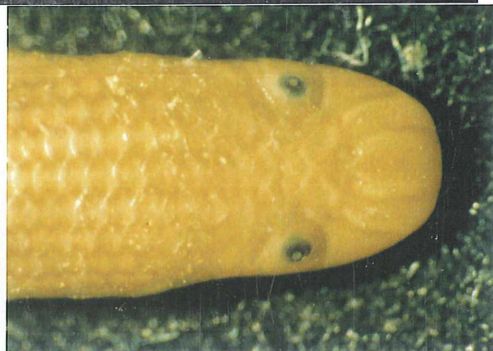


Fig. 64 Reptiles (next page / nächste Seite):

Coluber socotrae (GÜNTHER, 1881)

The species (total length up to almost 1 m) was described with the head olive above, the body with olive, sometimes black-edged transverse bands, separated by narrower salmon-red interspaces, as in the photos above and in the middle on the left. However there are also dark forms, as the specimen recorded in March 1999 on Samha (photo middle right).

Endemic, known from Socotra and Samha.

Top and middle left: *Coluber socotrae*, Socotra.

Middle right: *Coluber socotrae*, Samha.

Bottom: Head shields *Coluber socotrae*.

Their body is smooth, white to pink in colour and covered with small scales. Having only a small mouth they probably feed on small arthropods. Previous records are mainly from lower and middle zones in the hills (BOULENGER 1903), but in one case also from the southern coast (STEINDACHNER 1903). The two remaining species are colubrid snakes (WRANIK 1998). From records so far *Coluber socotrae* (GÜNTHER, 1881) seems to be most common on the lowlands of north and west Socotra, and is also known from Samha (STEINDACHNER 1903). The snake is described as strikingly coloured. However a record and some field observations of blackish specimens in 1999 indicates that there could be a greater colour variation in the species, or possibly a change with ageing. Also unclear is the distribution of *Dityopphis vivax* (GÜNTHER, 1881). There are records from Hadibo up to the mountains. CORKILL & COCHRANE (1965) suppose that the colouring, in conjunction with a short tail, keeled scales and vertical pupils, which give the species an appearance very similar to the viper *Echinus coloratus*, might be a reason for confusion and also an explanation for the „great many vipers“ mentioned in the "Periplus". The record of *Echinus coloratus* GÜNTHER, 1878 by Balfour in 1880 (BLANFORD 1881) is very controversial (WRANIK 1998). It is considered by the majority of authors as a locality error, because Balfour's team also investigated the mainland around Aden, where the snake is known to occur. Moreover, the accidental importation of a viper cannot be ignored as a possible explanation for Balfour's record (PARKER 1949). The most important arguments for the doubt about the record on Socotra are that no subsequent expeditions have rediscovered the species and that there is no knowledge of poisonous snakes among the local people. A Sokotri medical doctor at Hadibo hospital has never been faced with a serious case of snake bite or with persons, who suffered from haematuria, a characteristic of viperine poisoning, in a several years (WRANIK 1998).

To people living on Socotra reptiles are commonplace, and they have no great fear of them as the people have on the Yemen mainland. However despite being harmless, colubrids are sometimes killed by mountain dwellers as an old myth has led them to believe that snakes suckle their livestock for milk and by doing so they poison the animals. In addition there are folklore reservations about possible pollution and diseases from skinks and geckoes.

So far no traces of amphibians have been found on the archipelago, despite adequate water conditions and a number of species in the adjacent areas of Africa and Arabia, which are adapted to dry conditions. There is no conclusive explanation for this. A possible argument could be, that there were much more arid conditions in past periods.

Generally little is known about the fresh water biota and it is still controversial whether there are indigenous fresh water fishes on the island (TASCHENBERG 1883; FORBES 1903). A few years ago a number of streams, estuaries and wells were stocked with specimens of *Aphanius dispar* (RÜPPEL, 1828) (Cyprinodontidae) from the mainland during an anti-malaria campaign. It seems, that they have formed stable populations and that the predatory fish effectively control mosquito breeding by eating larvae. Because the fishes are non-selective in their food it is regrettable that this project was carried out without any research for possible side-effects within the almost unknown freshwater communities (Fig. 67).

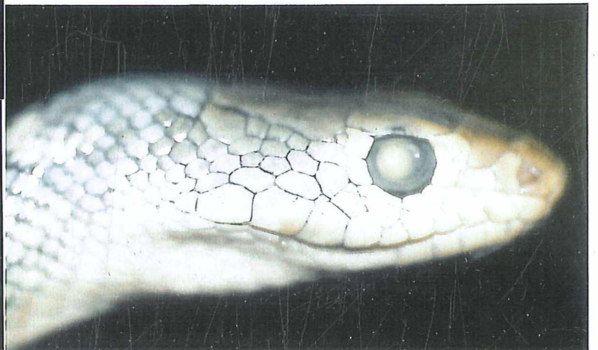
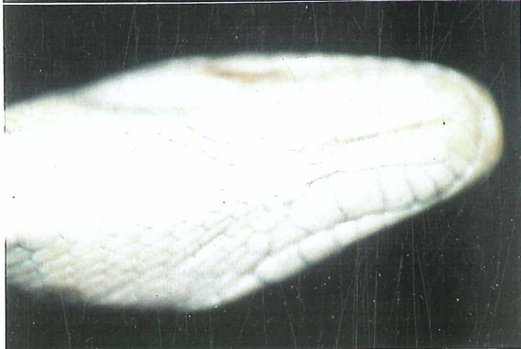


Fig. 65 Reptiles (next page / nächste Seite):

***Ditytophis vivax* (GÜNTHER, 1881)**

The genus *Ditytophis* is represented by a single species endemic to Socotra. The snake has a viperine aspect due to its short body (total length up to 440 mm), keeled scales and vertical pupil. Above it is uniform reddish-brown or sandy, with dark spots disposed alternately along the back.

Known only from Socotra.

Top & middle left: *Ditytophis vivax*, Diksam.

Middle left: Young specimen of *Ditytophis vivax*, Firmihin.

Bottom: Head shields of *Ditytophis vivax*.



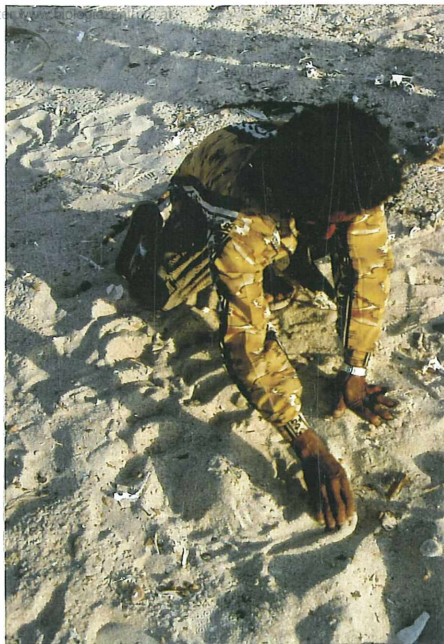


Fig. 66 Reptiles (previous page / vorige Seite):

The capture of marine turtles as well as the collection of turtle eggs are still a traditional means of providing supplementary food for the people, especially during the summer monsoon when fishing is difficult. We found a number of carapaces on the beaches of Socotra, Samha and Abd al Kuri, resulting from turtles being killed for food. There were carapaces of *Caretta caretta* (LINNAEUS, 1758), *Chelonia mydas* (LINNAEUS, 1758) and *Eretmochelys imbricata* (LINNAEUS, 1766). All species are known to occur in the waters of the archipelago. The nesting status of *Caretta caretta* is confirmed on Socotra.

Top: Dead marine turtle on Abd al Kuri and fisherman explaining the characters of nesting sites of marine turtles on sandy beaches, to collect turtle eggs.

Middle left: Carapace of *Eretmochelys imbricata*, Samha.

Middle right: Carapace of *Chelonia mydas*, Samha.

Bottom left: Carapace of *Caretta caretta*, Samha.

Bottom right: Carapace of a marine turtle used as container (Hadibo).

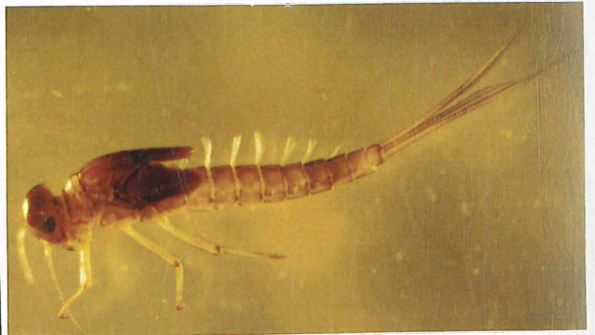


Fig. 67 Fish and semi-aquatic insects

Aphanius dispar (RÜPPELL, 1828)

This member of the family Cyprinodontidae is widely distributed between NE Africa and NW India, living under freshwater, brackish or marine conditions. The species is fairly common in freshwaters of Socotra too, but with a great probability these populations are the result of an anti-malaria campaign a few years ago, in which a number of streams, estuaries and wells were stocked with specimens of this predatory species, to control mosquito breeding. However the fishes are non-selective in their food, therefore there can be also side-effects within the almost unknown freshwater communities.

Top & middle: Stream in the mountains with *Aphanius dispar* and male specimen of this species.

Bottom: Larval stages of four semiaquatic insects:

Top left - Mosquito pupa (Diptera); top right - nymph of a may-fly (Ephemeroptera); bottom left - larva of a Corethridae (Diptera); bottom right - nymph of a caddis-fly (Trichoptera).

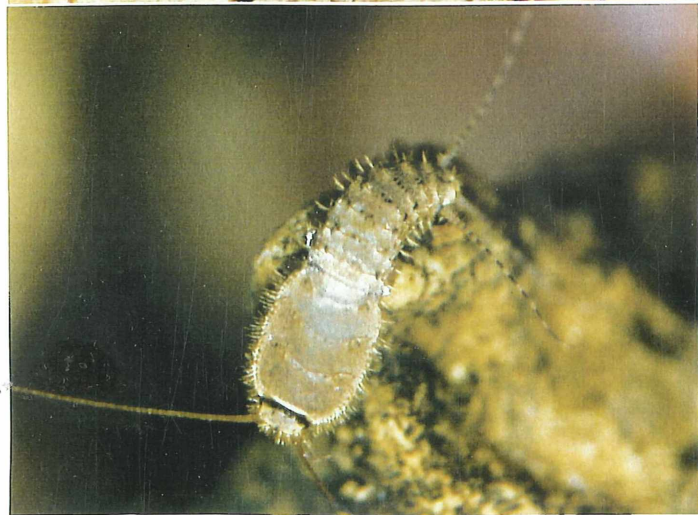


Fig. 68 Apterygote insects and Embioptera:

Not much notice has been taken so far of small forms, such as the wingless groups of primitive insects or the small and inconspicuous embiids. The elongate Thysanura are widely distributed and very common under stones, boulders or leaf-litter.

Top left: A large species from Abd al Kuri, not yet identified.

Top right: *Acrotelsa* sp. (Haghier mountains).

Middle left: *Ctenolepisma* sp. (Noged).

Bottom left: A Collembola, also known as springtails, recorded at Hadibo.

Bottom right: An apterous female of *Oligotoma saundersii* WESTWOOD, 1837. It is a common „weed“ species, widespread in commerce, like the other recorded species *Oligotoma humbertiana* (SAUSSURE, 1896).

There are vast numbers of invertebrates on the islands, mainly represented by arthropods and molluscs. However only a few groups have been recorded systematically up until now and revised more recently. This insufficient level of investigation is also demonstrated by the number of less than 600 insect species listed in literature so far. Some groups, like Thysanura, Collembola or Ephemeroptera, have not been mentioned at all, although they are thoroughly frequent in some habitats. And also a good number of insects caught by the turn-of-the-century expeditions still remain unidentified in one or the other museum collection. Another problem is the lack of data on the biology and seasonal changes in population, which seems to be very distinctive in a great number of species. Therefore some data on species number, the endemic state and identifications are provisional, and it will be a long time before all the recorded material can be positively identified.

Insects are often overseen, they seem to play no special role in the life of the local people, but in reality they are, of course, of basic importance. On the archipelago they are sole agents for pollinating a wide variety of trees and other plants, cleaning carcasses, feeding on dung and decaying vegetation, preying on and parasitizing each other and other organisms to maintain a healthy balance of numbers, and making themselves available as food to others; i.e. playing a critical role in keeping the balance of ecosystems. But they may also cause human death or disability by transmitting a number of diseases and bringing about crop losses.

The most important of the few organisms considered as useful by people are bees, because honey is highly appreciated and taken by experienced collectors from the nests of wild bees with the help of smoke. Of greater importance as pests are fleas, bugs, lice, as well as flies and mosquitoes (Fig. 89). There are a lot of potential mosquito breeding locations on the island, such as open hand-dug wells, open watering holes or even small natural depressions filled with rainwater. But the greatest source seems to be the water bodies along the coastal estuaries, where fresh water flowing along is dammed into small ponds which become polluted with vegetation growth, bacteria, putrefying animal excreta and household refuse. There are two Anopheline among the 11 recorded mosquito species (*Anopheles (Cellia) culicifacies adenensis* CHRISTOPHERS, 1924, *A. (Cellia) dthali* PATTON, 1905). The types of malaria identified on the island are *Plasmodium falciparum* and *P. vivax*, which are among the most severe forms of the parasite and treatment requires thorough medical attention. Being an isolated area with a rather limited population, eradication of malaria on Socotra is technically feasible by a campaign of mass drug administration over a period of one to two month and systematic screening afterwards. But this cannot be realized in practice due to the difficulties of nomadic and semi-nomadic life and all the other infrastructural limitations.

The mountain dwellers are also afraid of a fly which squeezes „small worms“ into the eyes and the mucous membranes of nose and mouth, causing painful inflammations. It is the bot-fly *Oestrus ovis* LINNAEUS, 1758, which is distributed practically worldwide, wherever sheep and goats are found. The adults take no food, but their larvae, which migrate into the nostrils and finally are found in the region of the ethmoid bone of sheep, goats, antelopes and other hoofed mammals. As soon as the larval stages are completed, the mature larvae drop to the ground to pupate. Though not a normal host, attacks on man are not unusual. But in humans the larvae are unable to develop beyond the first stage, probably due to the lack of proper conditions to transform.

Fig. 69 Odonata (next page / nächste Seite):

About 20 species of Odonata (four Zygoptera, sixteen Anisoptera) have been recorded from the archipelago so far. All but one are known from the surrounding African and Arabian mainland, more than half of the species are afrotropical.

Enallagma granti (MCLACHLAN, 1903)

E. granti is so far the only known endemic damselfly from Socotra. It is considered as a primitive member of its genus.

Top left: Male specimen of *Enallagma granti* (Socotra, Diksam).

Top right & bottom left: *Enallagma granti* mating and depositing of eggs (Socotra, Diksam).

Bottom right: *Enallagma granti* nymph and hatching of an adult (Socotra, Diksam).



Fig. 70 Odonata (next page / nächste Seite):

Top: *Enallagma nigridorsum* (SELYS, 1876) male specimen and depositing of eggs (Socotra, Diksam).

Middle: *Ischnura senegalensis* (RAMBUR, 1842) male and female (Socotra, Hadibo).

Bottom: *Ceriagrion glabrum* (BURMEISTER, 1839), Diksam.

Fig. 71 Odonata (page 181 / Seite 181):

Top left: *Diplacodes lefebvrei* (RAMBUR, 1842) (Socotra, Hadibo).

Top right: *Orthetrum chrysostigma* (BURMEISTER, 1839) (Socotra, Diksam).

2nd left: *Orthetrum sabina* (DRURY, 1773) (Socotra, Hadibo).

3rd left: *Macrodiplex cora* (KAUP in BRAUER, 1867) (Socotra, Hadibo).

Middle right: *Trithemis arteriosa* (BURMEISTER, 1839) (Socotra, Diksam).

Bottom left: *Pantala flavescens* (FABRICIUS, 1798) (Socotra, Hawlaf).

Bottom right: *Crocothemis erythraea* (BRULLE, 1832) (Socotra, Hadibo).



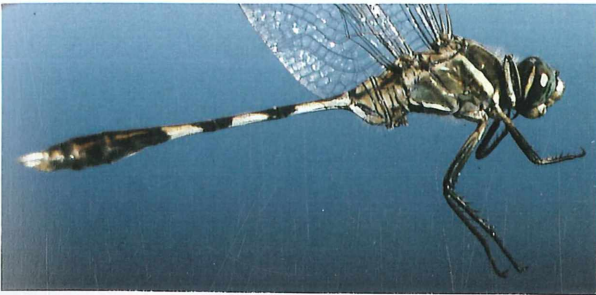


Fig. 72 Ensifera (next page / nächste Seite):

Based on distinct differences in habits and characters the group of the Saltatoria is divided into the Ensifera and Caelifera.

Most members of the Ensifera may be recognized by their antennae, which are longer than the body. They produce sound by rubbing together the two forewings and their hearing organs are situated on the forelegs. About one third of the known species from the archipelago belong to this group.

Top: *Pachysmopoda abbreviata* (TASCHENBERG, 1883) (Tettigoniidae) male (left) and female (right). This large species is common, but has mostly been found singly. It is nocturnal in habits, hiding by day under stones, in hollows of trees or similar places. *P. abbreviata* is considered to be a pest by the local people, because it is reputed to damage the young flowers and shoots of date palms (UVAROV & POPOV 1957).

2nd left: *Ruspolia basiguttata* (BOLIVAR, 1906) (Tettigoniidae) (Socotra, Firmihin).

2nd right: *Phaneroptera nana* FIEBER, 1853 (Socotra, Noked).

3rd: *Glomeremus pileatus* (KRAUSS, 1902) (Gryllacrididae) (Socotra, mountain slope Hadibo area). Male (left) and female (right). This endemic species is nocturnal and can be found by day under rocks and the bark of trees.

Bottom left: *Ectatoderus guichardi* GOROCHOV, 1993 (Mogoplistidae) (Socotra, Diksam).

Bottom right: *Gryllotalpa africana* (PALISOT, 1805), Hadibo area, BMNH collection.



Fig. 73 Ensifera (next page / nächste Seite):

Crickets and their relatives are rather common, although they are not often seen, because of their nocturnal habits. Most of them hide in the ground, under stones or in other suitable places by day and forage at night. Their nocturnal sounds are common in most parts of the island. The group needs further studies to clarify the status of the different forms.

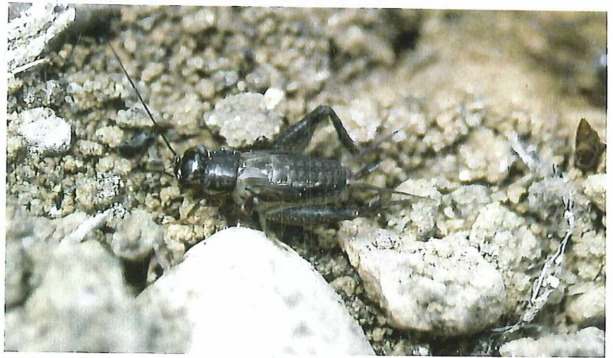
Top left: Larval stage of *Gryllus bimaculatus* DEGEER, 1773 (Gryllidae) (Socotra, Diksam).

Top right: *Gryllodes supplicans* (WALKER, 1859) (Gryllidae), Diksam.

Middle & bottom left: *Acheta rufopicta* UVAROV, 1957 (Gryllidae). Male (middle left), larval stage (middle right) and female (below left) (Hadibo & Diksam).

3rd right: *Modicogryllus perplexus* (OTTE & CADE, 1984) (Gryllidae), Diksam.

Bottom right: *Oecanthus chopardi* UVAROV, 1957 (Gryllidae), Hadibo plain.



The first stage larva is an elongate, largely transparent creature, about 1 mm in length with various small hooklets, and is therefore hard to see. There are a number of other flies, blood-sucking or scavenging, which could be of medical importance as transmitters of germs for typhoid, cholera, dysentery and other diseases. These risks usually overshadow the beneficial effects of a good number of flies, because besides harmless forms many species are predatory or parasitic and therefore of importance in controlling overall insect populations. One such example are the robber flies (Asilidae), which usually sit quietly waiting for a suitable prey to fly past. Their larval stages live in soil and rotting plants, where they prey or scavenge on small organisms. Another example are the bee flies (Bombyliidae), whose bodies are covered in a dense layer of short hairs and whose mouthparts are modified into a long, thin proboscis. While the adults usually feed on nectar, the larvae parasitize on the immature stages of other insects. But finally even the scavengers, like the members of the diverse group of blowflies (Calliphoridae) which are commonly seen on faeces or at fresh carcasses, help to maintain the balance in nature by converting dead and decaying organic material into simple chemical substances that can be used again by the plants.

The tropical bedbug *Cimex hemipterus* (FABRICIUS, 1803) was mentioned by Kirkaldy (FORBES 1903) as „very common“, but I haven't seen it once during my expeditions; in marked contrast to fleas, which are frequently carried by livestock and found in and around the caves and houses. The female fleas lay their eggs either on the host or on the ground, where the legless larvae feed on organic material. When fully grown they pupate within a cocoon among debris, in a crack or crevice, where they may remain for months. They only emerge when a suitable host is nearby, whose presence they detect by vibrations and, possibly, also by an increase in the level of carbon dioxide. So it is not uncommon that in suitable places fleas suddenly emerge in their hundreds having hope for a blood meal. We have recorded the species *Ctenocephalides felis strongylus* (JORDAN, 1927) and *Synosternus pallidus* TASCHENBERG, 1880, as well as the rat flea *Xenopsylla cheopis* (ROTHSCHILD, 1903). Among the various species that are supposed to transmit the bubonic plague, the latter cosmopolitan species is regarded as one of the more important ones. Also widespread seems to be the human head and body louse (*Pediculus humanus* and *P. capitis*). Louses are known to carry dangerous germs and can transmit serious illnesses, but there have been no studies of their medical importance, nor to any of the other pests on the island.

Beside these species with special importance for man, the archipelago of course provides a home for a great variety of further insects from various orders. The following mentions only some of the more important, interesting or spectacular examples.

The number of bristletails and silverfishes (Thysanura) is surprising (Fig. 68). The small carrot-shaped and wingless primitive insects are very common under stones from the coastal plain up to the mountains, but their speed makes them difficult to catch undamaged. Moreover, they are generally difficult to identify.

Common, and mainly found in the vicinity of water, are dragonflies (Odonata) (Figs. 69-71). About 20 species of Odonata have been recorded. The only endemic species is the damselfly *Enallagma granti* (MCLACHLAN, 1903), all others are widespread in Africa and Arabia. Aquatic nymphs are abundant in some parts of the streams, but it is difficult to identify them and therefore little is known about the specific habitats of the larval stages of the various species on the islands.

There have been also records of may- and caddis flies (Ephemeroptera / Trichoptera) in fresh water areas of Socotra, but for both groups we do not have identification up to species level (Fig. 67). The nymphs of mayflies are rather common in some habitats. They are unlikely to be confused with other forms, because of the typical gill protuberances on their abdomen, which are lamellate in the recorded specimens, and the three thread like caudal appendages. The adults of these larvae are still unknown. A few Trichoptera larvae have been recorded, which seem to belong to the Hydroptilidae, but specimens of the adults, which resemble some groups of Microlepidoptera, have yet to be discovered.

The Socotran Saltatoria show distinct Ethiopian and Eremian affinities, with more than half of the about 50 species being endemic, most of them either flightless or poor fliers, representing relics of the Tertiary fauna of the African continent (UVAROV & POPOV 1957). The non-endemic species are in contrast good fliers and have a relatively wide distribution in Africa and Arabia (Figs. 72-77).

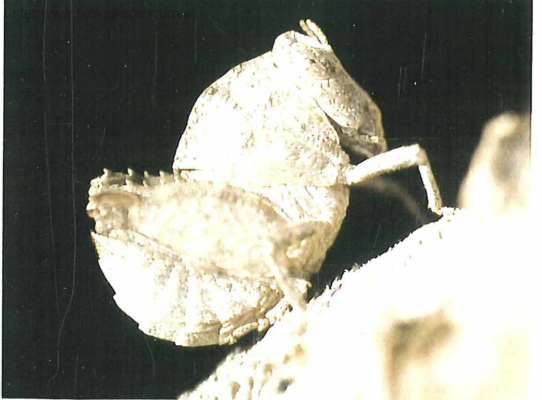
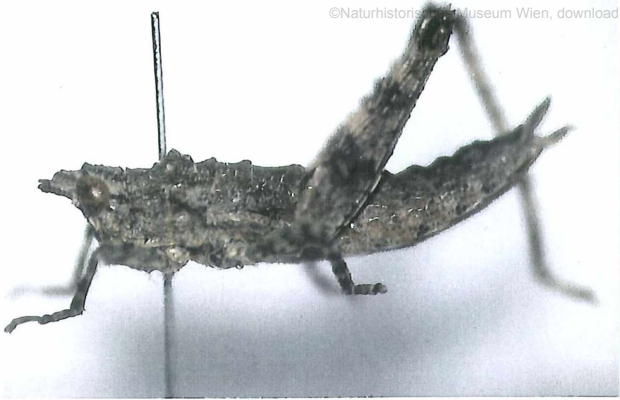


Fig. 74 Caelifera (previous page / vorige Seite):

About two third of the Socotran Saltatorians belong to the Caelifera. Short antennae are their typical character and in case of producing sound, they do it usually by rubbing the hind legs against the forewings. Their auditory organs are situated on the first abdominal segment. The vast majority of species is diurnal.

Top left: *Socotrella monstrosa* POPOV, 1957. All five known members from Socotra of the family Thericleidae are strange looking endemics. The coarse sculpturing and the dark grey coloration of *S. monstrosa* seems to be a cryptic adaptation to its mode of life on branches of trees and bushes.

Top right & 2nd: *Phaulotypus* cf. *insularis* BURR, 1899 (Thericleidae), at Diksam. The small specimens, which can be found on plants or on the ground, are easily overseen.

3rd: *Physemophorus sokotranus* (BURR, 1898), Hadibo plain.

This Socotran endemic belongs to the Pyrgomorphidae, the true bush hoppers. The species is not uncommon and can be found usually singly from the coastal plain up to the mountains, often in the shelter of shrubs. A distinct character of *P. sokotranus* is the small cylindrical tubercle on the first tergite which projects between the wings.

Bottom: *Pyrgomorpha conica tereticornis* (BRULLE, 1840) (Pyrgomorphidae), Hadibo plain. The so called „*conica-bispinosa-cognata* group“ constitutes an assemblage of closely related and morphologically very similar forms of the genus *Pyrgomorpha*. According to POPOV (1997) two taxa occur on the archipelago. One is the endemic subspecies *P. conica kurii* HSIUNG & KEVAN, 1975, which is restricted to Abd al Kuri, while the specimens on Socotra are much closer to *P. c. tereticornis*. The species is common in all drier parts of the island and it is variable in colour from greenish to grey.

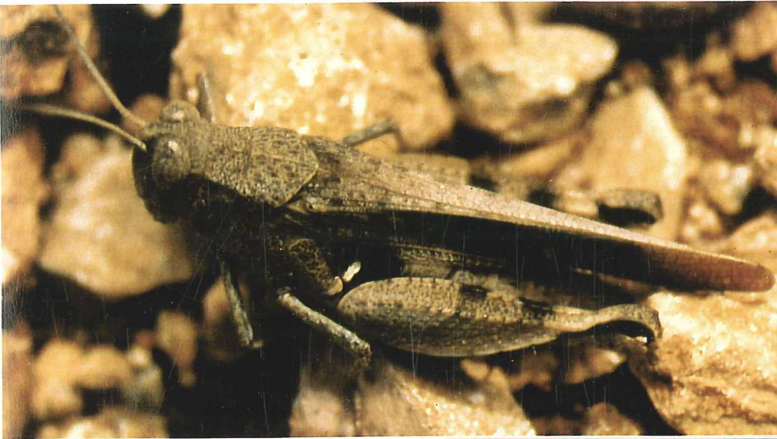
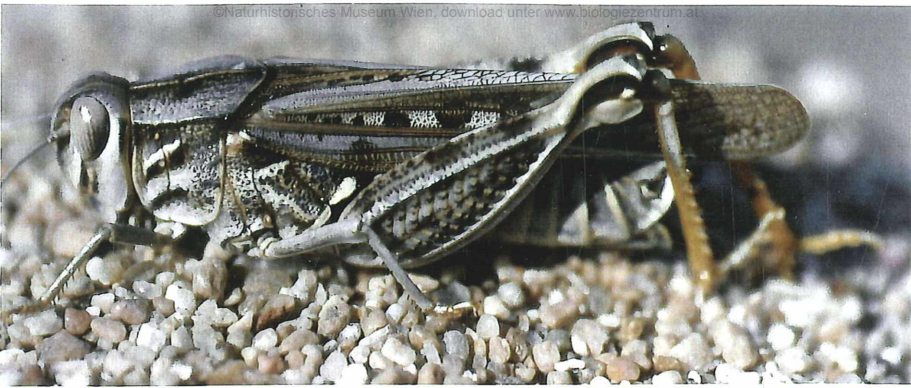
Fig. 75 Caelifera (next page / nächste Seite):

Top: *Acorypha glaucopsis orientalis* (UVAROV, 1950) (Acrididae), Hadibo plain. The species is geophilus and can be found on open stony or gravelly areas from the coastal plains up to the mountains.

Middle left: Two photos of *Acorypha bimaculata* (KRAUSS, 1902) (Acrididae), Hadibo plain. This endemic is one of the most conspicuous grasshoppers on the island by the crackling noise which it emits in flight and the rose hind wings, it occurs from the plain up to the mountains. In contrast to *A. glaucopsis orientalis* it seems to prefer the more wooded areas (UVAROV & POPOV 1957).

Middle right: *Diabolocatantops axillaris* (THUNBERG, 1815) (Acrididae), Hadibo plain. The species is widespread in Africa and Arabia, and one of the commonest grasshoppers on Socotra. It occurs in a variety of habitats, but usually in those places where the vegetation is denser.

Bottom right: *Scintharista forbesii* (BURR, 1899) (Acrididae) occurs on dry, gravelly hillslopes at all altitudes. The endemic is geophilus in its habits and characterised by blackish hind wings. In flight it often produces a sharp cracking noise.



The greater number of forms are geophiles, and their distribution appears to be not very much dependent on the geological or chemical character of the soil, but on its surface. Also the choice of the habitat by phytophiles is probably more influenced by the structure of the vegetation rather than its floristic composition (UVAROV & POPOV 1957).

The local people neither use grasshoppers, crickets and their relatives as food, nor do they pay greater attention to them. The large brownish species *Pachysmopoda abbreviata* (TASCHENBERG, 1883) is nocturnal, hiding by day under rocks or in other suitable places. It is considered to be a pest, because it is reputed to damage young flowers and shoots of date palms (UVAROV & POPOV 1957). Most other members of the Tettigoniidae (Ensifera) are greenish and live on trees or shrubs. The Gryllidae, belong to the species which are more often heard than seen. They are terrestrial in their habits, strictly nocturnal and difficult to approach, but already shortly after dark their musical trill is one of the common nocturnal sounds on the island. Forming part of this group is the tree cricket *Oecanthus chopardi* UVAROV, 1957, which is usually found sitting on shrubs. Mostly subterranean is, however, the life of the mole cricket *Gryllotalpa africana* PALISOT & DE BEAUVOIS, 1805. The members of the Gryllacrididae are also nocturnal. The three Socotran species belong to the Afrotropical Genus *Glomeremus* KARNY, 1937, which contains some 20 species. They are yellowish in colour with castaneous and black markings and can be found under rocks and the barks of trees during the day.

However Saltatoria also can be seen frequently during the day on soil, stones and vegetation in many parts of the islands. Easily overseen because of its small size is *Paratettix* sp., which is locally quite common on grassy banks of watery areas. Comparatively small are also the bizarre shaped, four endemic species of the Genus *Phaulotypus* BURR, 1899, which can be found occasionally on the ground, or on plants or trees. The remarkable *Socotrella monstrosa* POPOV, 1957 seems to be phytophilus in its habit, and is well camouflaged by living on the bark of trees. *Pyrgomorpha conica tereticornis* (BRULLE, 1840), with a typical conical head, is not uncommon in drier parts of Socotra. *Physemophorus sokotranus* (BURR, 1898) is characterized by a knob-like tubercle on the dorsal side, which projects between the base of wings. Its fine structure and function have not been studied, but field experiments failed to detect any discharge (POPOV, pers. inform.).

However, the members of the Family Acrididae (grasshoppers and locusts) are also most abundant on the Archipelago. One of the most common forms is *Diabolocatanops axillaris* (THUNBERG, 1815), which is also widespread in Africa and Arabia. Typical characteristics of *Acorypha bimaculata* (KRAUSS, 1902) are rose hind wings and a crackling noise which is emitted while flying. Strange looking is the wingless endemic *Dioscoridus depressus* POPOV, 1957. Still relatively scanty is the knowledge of Desert Locust on the Archipelago. POPOV (1959) reported three cases of breeding (winters 1942/43, 1950/51 and 1951/ 52), an immature swarm in June 1952, and the record of a few adults in Summer 1956, but the origin of the swarms which arrived and bred in Socotra was probably in the Indo-Pakistan area. We recorded one single specimen near Dilicia in 1998, but with regard to the non-swarming phase there is still need for further research, how far the Desert Locust *Schistocerca gregaria* (FORSKAL, 1775) occurs principally in the sandier parts of the Archipelago. The members of the Oedipodinae are common in bare gravelly and sandy areas, but are well adapted due to their protective coloration. The typical character of *Truxalis viridifasciata* (KRAUSS, 1902) is the conspicuous head shape. No studies have been done so far on the particular songs of the various species.

Fig. 76 Caelifera (next page / nächste Seite):

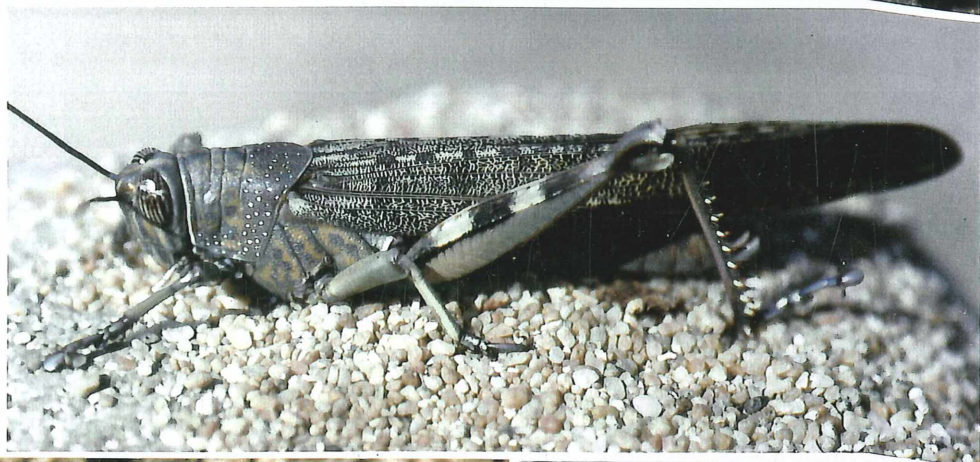
Top left: *Ochrididia kraussi* (I.BOLIVAR, 1913). Hadibo plain.

2nd: *Anacridium melanorhodon arabäfrum* DIRSH, 1953. Hadibo plain.

3rd left: *Aiolopus thalassinus* (FABRICIUS, 1781). Hadibo plain.

3rd right: *Leva socotrana* POPOV, 1957. Hadibo plain.

Bottom: A female specimen of the strange looking *Dioscoridus depressus* POPOV, 1957. Hadibo plain.



Two endemic Mantodea (Socotra, Samha) and one non-endemic (Abd al Kuri) species have been recorded. These predatory insects usually sit on twigs or leaves, and are well camouflaged (Fig. 78).

Earwigs (Dermaptera) are generally nocturnal, and retract to protected locations during the day. Beside the large *Lapidura bengalensis* DOHRN, 1863 at least two other forms have been recorded (Fig. 78).

Also nocturnal is a considerable number of cockroaches (Blattodea). Besides the well known cosmopolite *Periplaneta americana* LINNAEUS, 1766, which was found in houses of Hadibo, three smaller and endemic free living forms have been mentioned in the literature (Fig. 78).

Only two species of termites, both endemic, have been described from Socotra (Fig. 79). As typical for these minute whitish insects, they avoid all possible contact with light and free air, preferring the dark humid atmosphere of the nest. *Amitermes socotrensis* HARRIS, 1954 builds conical clay mounds, whereas *Procryptotermes dioscurae* HARRIS, 1954 is a dry-wood termite (HARRIS 1954).

Closely related are the embiids, or web spinners (Embioptera) (Fig. 68). They live in small colonies under stones, below bark or similar protected environment and have the special ability, regardless of developmental stage or sex, to spin numerous strands of silk with each stroke of their enlarged, gland-packed foretarsi. In these self-created labyrinths of galleries they are rarely seen because of their secretive habit. They can avoid predators by running rapidly in reverse. Feeding on dead outer bark, dead leaves, lichens, or moss, they lack of known economic importance, but are of great zoological interest. All embiids are uniformly coloured in shades of brown. The females are wingless, while the males have soft wings which are used for dispersal flights to enter other colonies for mating and genetic exchange. A species identification is difficult. The recorded specimens on Socotra belong to *Oligotoma saundersii* WESTWOOD, 1837 and *O. humbertiana* (SAUSSURE, 1896). Both are widespread, even occurring in North America and South East Asia, and are common „weed“ species. We are indebted to Edward S. Ross (California Academy of Sciences) for the expert opinion on taxonomy and zoogeography of the Embioptera.

Not much notice has been taken so far of small forms, such as booklice (Psocoptera), aphids (Aphidoidea) or scale insects (Coccoidea) (Fig. 82). The number of species will increase in all these groups by a more systematic survey. This will be also in the true bugs (Heteroptera), despite the previous knowledge of about thirty species (Figs. 80-81). Represented in terrestrial habitats are burrowing bugs (Cydnidae), shield bugs (Pentatomidae), seed bugs (Lygaeidae & Pyrrhocoridae), plant bugs (Miridae), and the already mentioned bed bug (Cimicidae). Common are also various forms of assassin bugs (Reduviidae). They stalk other insects, and like praying mantis, some species have raptorial forelegs to aid in grasping prey. However there are also some freshwater species: Water striders (Veliidae and Mesoveliidae) can be seen skimming along the surface of the water, and water repellent hairs on the legs and on the ventral body surface prevent them from sinking. They are either scavengers, or prey on other small organisms which have fallen into the water. Two species have been recorded (*Rhagovelia infernalis socotrensis* BROWN, 1956 and *Mesovelia vittigera* HORVÁTH, 1895). The backswimmers (Notonectidae) have the unusual habit of swimming upside-down by means of enlarged hind legs which are flattened and equipped with fringes of hairs. They have a longitudinal keel stretching along the midventral line of the abdomen, on each side with a hair-covered groove where air is stored, enabling the specimens to breathe below water. The species *Anisops debilis socotrensis* BROWN, 1956 is rather common in both, streams and stagnant waters. Also the water-boatmen (Corixidae) have a pair of large, oar-like hind legs fringed with hairs, but they do not swim upside-down. Most feed on microscopic organic matter, but others are predatory. Known from Socotra is *Sigara lateralis* (LEACH, 1817).

Fig. 77 Caelifera (next page / nächste Seite):

Top right: *Sphingonotus turkanae* UVAROV. Hadibo plain, dry and sandy or gravel habitats.

2nd: *Sphingonotus canariensis* SAUSSURE. Hadibo plain, dry and sandy or gravel habitats.

3rd: *Acrotylus incarnatus* KRAUSS, 1907. Hadibo plain, dry and sandy habitats, variable in colour.

Bottom: *Truxalis viridifasciata* (KRAUSS, 1902). Hadibo plain.



Fig. 78 Mantodea, Dermaptera and Blattodea (next page / nächste Seite):

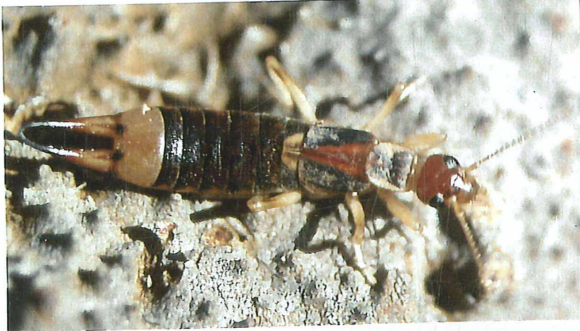
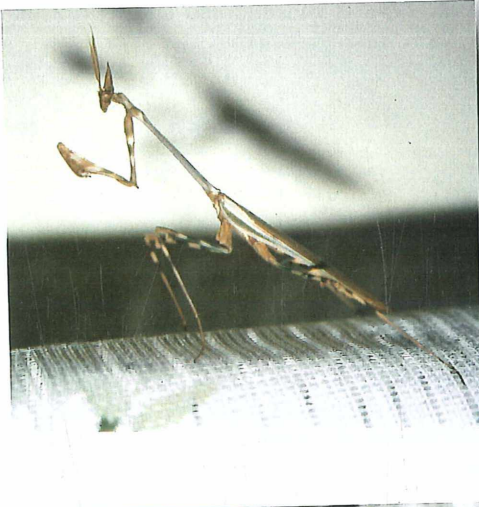
Top: *Teddia dioscoris* BURR, 1899. Firmihin.

2nd: *Empusa simonyi* KRAUSS, 1902. Hadibo.

3rd left: *Labidura bengalensis* DOHRN, 1863. Homhil.

3rd right: *Anechura socotrana* BURR, 1905. Firmihin.

Bottom: Two taxa of cockroaches from the mountains, not yet identified. The group needs more attention to clarify the number and status of valid species living on the archipelago.



The Auchenorrhyncha are listed with only two species, but a greater number of collected specimens, among them also large forms of the family Cicadidae, have not been identified so far (Fig. 82). It is possible to hear the typical chirping of specimens during the night, but there have been no detailed sound studies. Unknown are also any details on the life cycle, such as the duration of time the larvae feeding on roots in the ground, and the period of occurrence of the adults.

Darkling beetles (Tenebrionidae) are most common among the Coleoptera (Figs. 83-85) and widespread on the Archipelago. More than 30 species have been recorded (SCHAWALLER pers. inform.), most of them are endemic. Nearly three quarters of the 20 endemic species identified by KOCH (1970) indicate a definite Somalarabic relationship, while the remainder was interpreted as relics from a more ancient fauna, already extinct on the mainland. The petrophilous species are omnivorous, feeding on various matter, but can even survive long periods without eating. Besides their ability to live on dry food without water, they are also extremely waterproofed. Tiger beetles (Cicindelidae) remain mostly unnoticed. They are active by day in the sunlight and show a rapid mobility to run or to fly for a short distance. Both, larvae and adults, are efficient predators. *Myriochile melancholica* (FABRICIUS, 1798) and *Lophyrda aulica* (DEJEAN, 1831) were found around the estuaries and other moist habitats, where the species are not only restricted to the soil, but even crosses the algal mat floating near the shore (WRANIK et al. 1991). *Socotrana labroturrita* CASSOLA & WRANIK 1998 is endemic and represents a new cicindelid genus. It has been caught only once among stones in the mountains. The number of recorded ground beetles (Carabidae) is not more than about a dozen. *Caminara chlerostictum* DEJEAN, 1831 is the largest species recorded so far from the Archipelago. It was found alive in Hadibo as well as in the mountains of Socotra, and the rest of a wing on Abd al Kuri. *Pheropsophus* cf. *africanus* (DEJEAN, 1825) is a so-called bombardier beetle, which is characterized by the highly sophisticated method of defence in which they produce an explosion in their abdomen by mixing two different body chemicals. Less striking are the small *Tetragonoderus flavovittatus* WATERHOUSE, 1881, or members of the genera *Chlaenius* BONVOULOIR, 1809 and *Tachys* STEPHENS, [1829] 1828, which seem to be all nocturnal, but may be exposed when stones are turned over.

The largest aquatic beetle (about one dozen species) is the Short Legged Diving Beetle *Cybister africanus tripunctatus* CASTELNAU, 1834 (Dytiscidae), with a size of up to 3 cm. Both, adults and larvae, are predacious. Easier to detect, however, are the whirligig beetles (Gyrinidae). They are also oval in shape and have the middle and hind legs flattened, while the front legs are used to capture prey. Another distinct characteristic of these beetles is that they appear to have four eyes. But in fact, each eye is only divided into two and separated, so that the specimen can see above and below the water simultaneously. Numerous specimens of *Dineutus aereus* KLUG, 1834 leave their graceful curves on the water surface in many places on Socotra.

Fig. 79 Isoptera (next page / nächste Seite):

Only two species of termites have been described from Socotra. FORBES (1903) distinguished already between one form which erects a terminatum of a red clay on the surface of the ground, as a rule on bare treeless spaces, and another one which lives in the hollows of dead branches.

Conical clay mounds seems to be typical for *Amitermes socotrensis* HARRIS, 1954, while *Procryptotermes dioscurae* HARRIS, 1954 is a dry-wood termite.

However there seem to be more species than these two on the island.

Top left: Conical clay mound, plain east of Hadibo.

Top right: Termite colony around the branches of a shrub.

Middle: Colony of *Procryptotermes dioscurae*, plain east of Hadibo.

Bottom left: View into a colony of *Amitermes socotrensis* with a winged generation before mating fly.

Bottom right: *Amitermes socotrensis* (above) and head region of an unknown species (below).

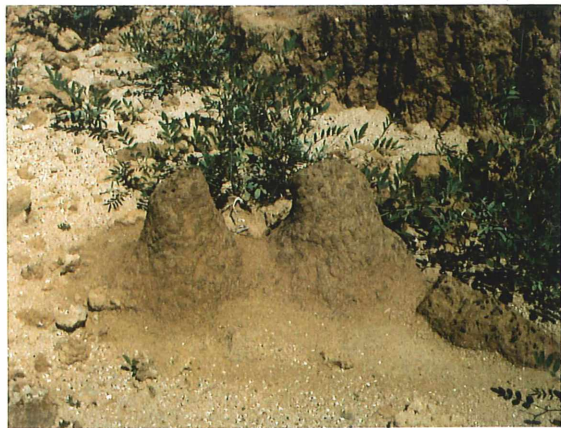


Fig. 80 Heteroptera (next page / nächste Seite):

The Heteroptera belong to the groups which need more intensive studies to get a view on the real species structure.

Above: Two forms of Reduviidae, not yet identified. The „assassin bugs“ stalk other insects, on which they prey.

2nd left: *Reduvius azrael* KIRKALDY, 1899 (Reduviidae).

2nd right: *Tenosius proletarius* (SCHAUM, 1853) (Alydidae).

3rd left: *Leptocoris bahram* (KIRKALDY, 1899) (Rhopalidae).

3rd right: *Spilostethus pandurus* (SCOPOLI, 1763) (Lygaeidae).

4th left: *Scantius forsteri* (FABRICIUS, 1781) (Pyrrhocoridae).

4th right: *Dieuches forbesii* (KIRKALDY, 1899) (Lygaeidae).

Below left: *Acrosternum millierei* (MULSANT & REY, 1866) (Pentatomidae).

Below right: *Dasynemus sahlbergi* BERGROTH, 1898 (Reduviidae).



Fig. 81 Heteroptera (next page / nächste Seite):

Water living bugs are rather common in the streams and stagnant pools of Socotra.

Top: Two species of backswimmers (Notonectidae) have been recorded on Socotra, these are *Anisops debilis socotrensis* BROWN, 1956 (photo) and *Anisops varia* FIEBER, 1852.

2nd: The Veliidae are present with *Rhagovelia infernalis socotrensis* BROWN, 1956 (photo) and *Microvelia popovi* BROWN.

3rd: The palaeotropical *Mesovelia vittigera* HORVATH, 1895 (Mesoveliidae).

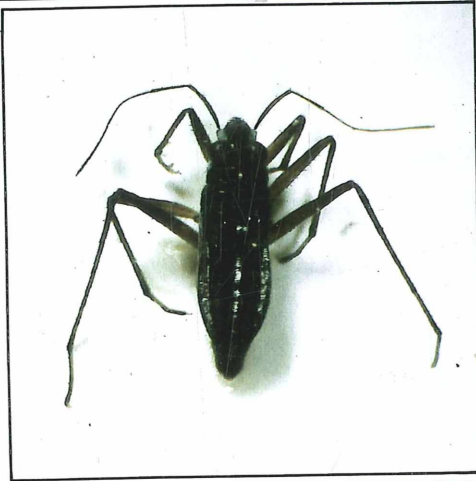
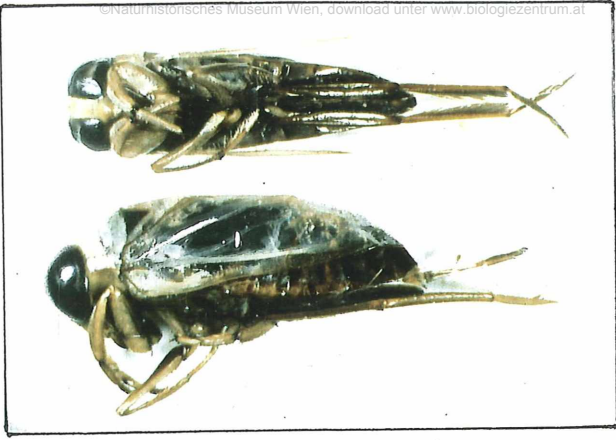
Bottom: *Sigara lateralis* (LEACH, 1817) (Corixidae).

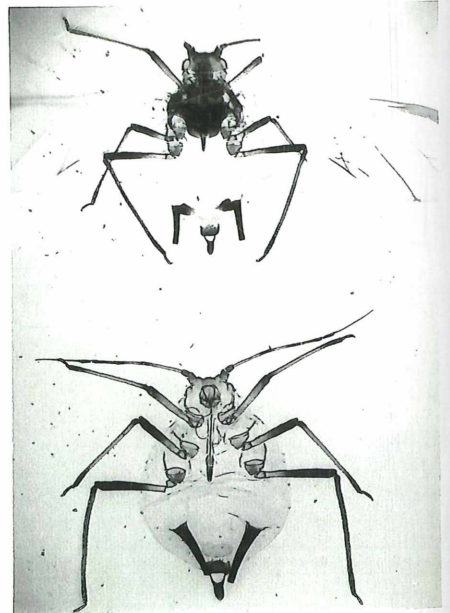
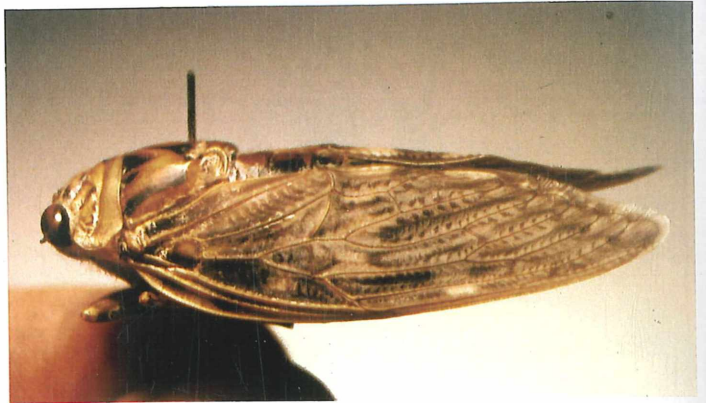
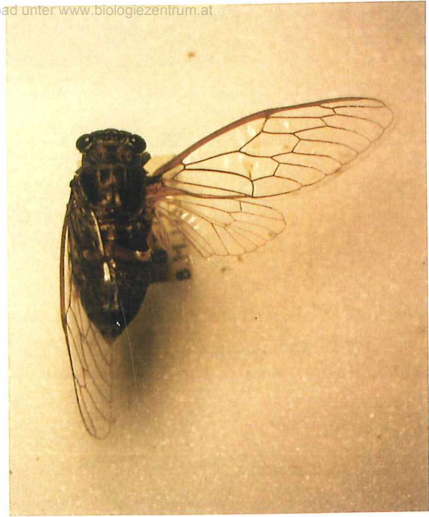
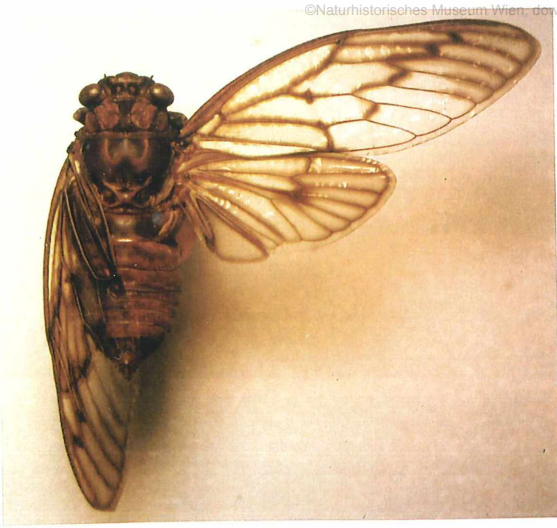
Fig. 82 Homoptera (page 202 / Seite 202):

Top & middle: The Auchenorrhyncha are listed with only two small species. Those larger cicadas on the photos are still undescribed. They were collected by Guichard in 1967 and are stored in the British Museum of Natural History, London. During my own stays I have not found living specimens of such large cicadas, but a greater number of exuviae near the ground of trees (photo middle left).

Bottom: Not much notice has been taken so far of small forms, such as booklice (Psocoptera), aphids (Aphididae) or scale insects (Coccidae).

The aphid on the photos is *Aphis nerii* BOYS DE FONSCOLOMBE, 1841 (Aphididae), which is widespread in the tropics and subtropics. Its hosts are plants of the families Asclepiadaceae and Aponyaceae.





Beetles of various families can be found in and on the droppings of livestock, carcasses, carrion or other decaying material. There are histerids (Histeridae), which are generally small in size, have short legs, and a rounded body, metallic-black in colour. Most common are those of the genus *Saprinus* ERICHSON, 1834. Roove beetles (Staphylinidae) are easily recognized by their narrow, elongate shape, and the greatly shortened elytra, which cover only about half the abdomen. They are proficient runners and also flyers, the fully developed hind wings are folded beneath the short forewings when not in use. The family shows a great variation in habits, besides being scavengers, there are also plant feeders and predators, while others live in the nests of ants or termites. The bluish *Necrobia rufipes* (DEGEER, 1775) is the only checkered beetle (Cleridae) that has been observed. It feeds on flesh and deposits of carrion, but preys also on blowfly maggots. Skin beetles (*Dermestes vulpinus* FABRICIUS, 1781) are abundant at carcasses, feeding on pieces of drying flesh, sinew or skin. If left undisturbed, thousands of larvae may occur, which are brown in colour, have tufts of hair covering the body surface and gnawing on the organic substrate. Most of the true dung beetles (Scarabaeinae) are only a few millimetres in length, but there are also some medium sized species, such as the endemic *Cheironitis socotranus* GAHAN, 1900. While some species make their nests within the dung pad itself, other tunnel into the soil below the dung. They excavate a chamber, stock it with selected bits of dung shaped into small compartments, with each compartment containing an egg. In some dung beetles, the male specimens show an extension on the head. This is most distinct in the male rhino beetles (Dynastinae), which are represented by species *Oryctes vicinus* GAHAN, 1900. Its large white larvae feed probably on the roots of living plants or on rotting vegetation.

The most attractive species on Socotra is *Mallodon arabicus* BUQUET, 1843, with a length of more than 60 mm. Its large white grubs tunnel inside decaying trees.

The endemic *Eryxia socotrana* GAHAN, 1903 is a more common member of the large family of leaf beetles (Chrysomelidae).

Most click beetles (Elateridae) are fairly small in size, but the endemic *Calais sulcicollis* (GAHAN, 1903) may reach nearly 30 mm. The characteristic feature of the members of this family is the flicking motion produced when the tension of two body parts pressed against each other is suddenly released. The beetles resort to this action when turned on to their back. Their larvae, commonly known as wire worms, have a well sclerotized, yellow-brown cuticle, and are usually found tunneling in rotten wood or soil.

Colourful, but remarkable variable and also seasonal in its occurrence, is the large Jewel beetle *Julodis clouei* BUQUET, 1843. There is no information on the life of its legless larvae, but it can be supposed that they feed on roots or bore into wood.

The ladybird beetles (Coccinellidae) are easily recognizable by the characteristic shape and spots or stripes on their coloured wings. Most species are predatory, both as larvae and as adults, and can be found, above all, on those parts of plants which are infected by aphids, scale insects or other homopterans. The two recorded species (*Cheilomenes lunata* (FABRICIUS, 1775); *Henosepilachna elaterii orientalis* ZIMMERMANN, 1936) are also widespread on the mainland.

Fig. 83 Coleoptera (next page / nächste Seite):

Top left: *Myriochile melancholica* (FABRICIUS, 1798) (Cicindelidae).

Top right: *Socotrana labroturrita* CASSOLA & WRANIK, 1998 (Cicindelidae).

2nd left: *Pheropsophus cf. africanus* (DEJEAN, 1825) (Carabidae).

Middle right: *Caminara chlorostictum* (DEJEAN, 1831) (Carabidae).

3rd left: *Chlaenius* sp. (Carabidae).

Bottom left: *Tetragonoderus flavovittatus* WATERHOUSE, 1881 (Carabidae).

Bottom middle: *Cybister africanus tripunctatus* CAST. (Dytiscidae).

Bottom right: *Dineutus aereus* KLUG, 1834 (Gyrinidae).

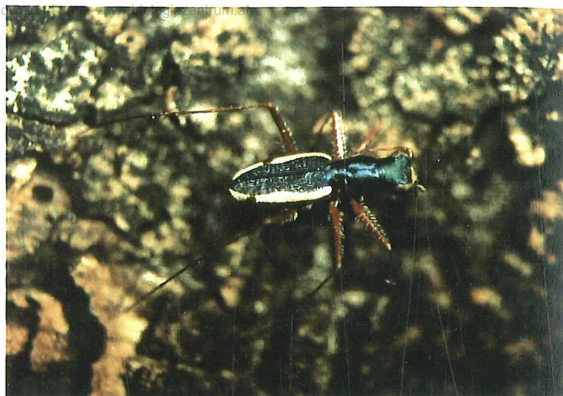
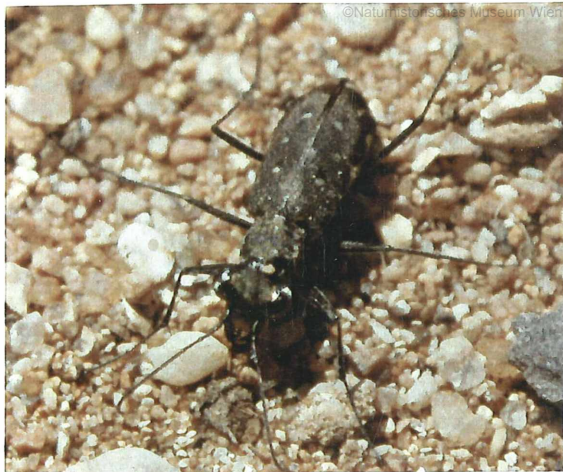


Fig. 84 Coleoptera (next page / nächste Seite):

Top left: *Histeromorphus plicatus* KRAATZ, 1865 (Tenebrionidae).

Top middle: *Opatrum costiferum* WATERHOUSE, 1881 (Tenebrionidae).

Top right: *Adelostoma bicarinatum* WATERHOUSE, 1881 (Tenebrionidae).

2nd left: *Meloe trapeziderus* GAHAN, 1903 (Meloidae).

2nd right: *Eusyntelia* sp. (Tenebrionidae).

3rd left: *Julodis clouei* BUQUET, 1843 (Buprestidae).

3rd middle: A new taxon of *Propsephus* HYSLOP, 1921, which is under description (Elateridae).

3rd right: *Cheironitis socotranus* GAHAN, 1900 (Scarabaeidae).

Bottom: Male and female specimen of *Oryctes vicinus* GAHAN, 1900 (Scarabaeidae).

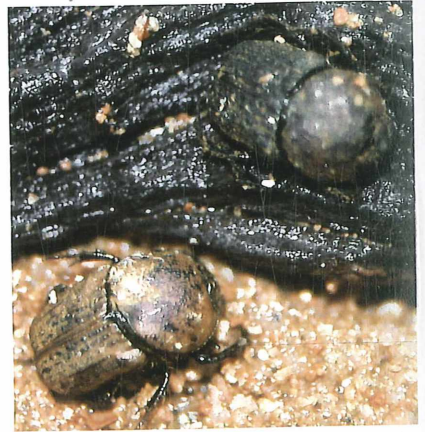




Fig. 85 Coleoptera (previous page / vorige Seite):

Top: Habitat, larva, pupa and adult stage of *Mallodon arabicum* BUQUET, 1843 (Cerambycidae).

Middle left: *Eryxia socotrana* GAHAN, 1903 (Chrysomelidae).

4th right: Brenthididae, not yet identified.

Bottom: Two species of weevils (Curculionidae). The species on the left not yet identified, and the common *Piazomias vermiculosus* WATERHOUSE, 1881 on the right.

The head of the dark reddish brown shot-hole beetles (Bostrychidae) is usually deflexed, and protected by the thorax, which is then hood-like in form. Their larvae live in unhealthy trees or drying wood. Sometimes the bluish *Meloe trapeziderus* GAHAN, 1903 can be seen crawling around. It belongs to the blister beetles (Meloidae), which can exude an oily secretion from its joints which is distasteful and may produce painful blisters on the skin. Their wing-covers are not only short, but instead of meeting in a straight line down the back, they overlap at their bases. Various weevils (Curculionidae) can be found under stones or the bark of trees, but only a few have been identified, as the larger *Piazomias vermiculosus* WATERHOUSE, 1881. Straight snouted weevils (Brenthididae) have been also collected at several localities on Socotra. They resemble curculionids in appearance and habits, but can easily be distinguished by their elongate shaped body and the antennae, which are not elbowed, as are those of the weevils.

Ant lions (Myrmeleontidae) are frequent visitors to light in the dark (Fig. 86). They superficially resemble damselflies, but in fact belong to the Order Neuroptera. There are a number of distinct characteristics which help to distinguish between the species easily. Most ant lions are nocturnal and fly clumsily; and they have prominent antennae. Furthermore they have the ability to fold back their multi-veined wings at rest roof-like over the abdomen. Best known are the Myrmeleontids for the characteristic cone-shaped pits that are made by the larvae of most species. They construct them by moving backwards in a circle, digging into the soil as they go and flicking away excess sand with their heads. Such pits can be found on the islands in suitable areas in large numbers. The larvae lie at the bottom of the pit half buried and the vicious jaws wide open, waiting that small insects stumble into these traps. They are extremely hardy, can remain active at high temperatures, and may go also several weeks without eating. A fully grown larva digs into the soil and spins itself a protective silken cocoon.

The adults of the Nemopteridae are strange looking, because of their unusual wing shape. Two species have been recorded from Socotra. We found larval stages on the ground of a cave. Species of Mantispidae have not been identified. They resemble a preying mantis by the elongate neck and the raptorial forelegs, but can also be easily distinguished from it by having both pairs of wings soft and membranous, and similar in size and shape.

Fig. 86 Neuroptera (next page / nächste Seite):

Top: Cone-shaped pits of antlion larvae and antlion.

2nd left: *Morter alternans* (BRULLE, 1840) (Myrmeleontidae).

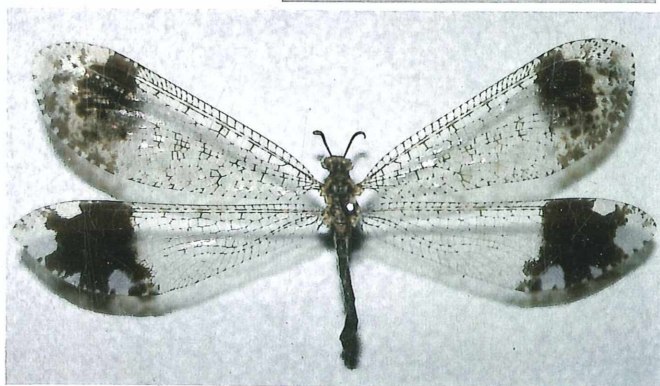
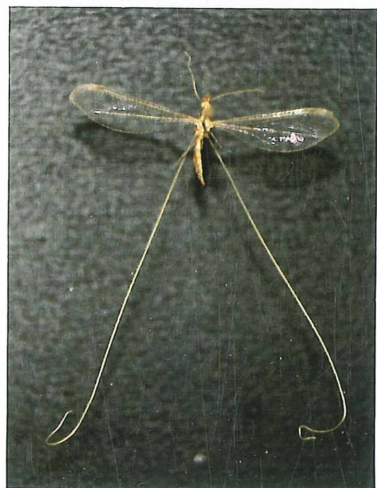
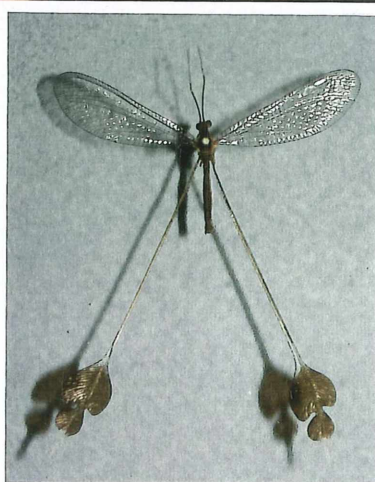
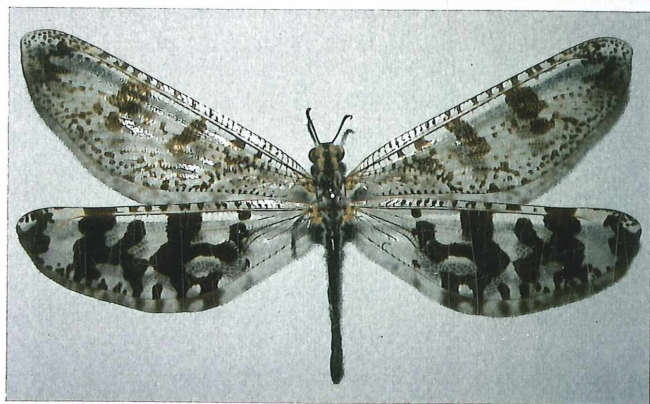
2nd right: *Palpares angustus* (MCLACHLAN, 1898) (Myrmeleontidae).

3rd left: *Echthromyrmex insularis* KIMMINS, 1960 (Myrmeleontidae).

3rd right: *Parasicyoptera guichardi* TJEDER, 1974 (Nemopteridae).

Bottom left: *Josandreou pusilla* (TASCHENBERG, 1883) (Nemopteridae).

Bottom right: *Neleoma socotrana* (TASCHENBERG, 1883) (Myrmeleontidae).



Well represented, but not very well studied are the Hymenoptera (Figs. 87-88). Fewer than 90 species have been listed in the literature so far. Wasps, bees, ants and their relatives also play a large role in helping to maintain a natural balance in the ecological web on the Archipelago, because of the numerous parasitic species, forms which prey on other arthropods or are essential for pollination. Besides these basic functions, many species are interesting because of their biology, so for example in nest constructions, or how a nest is stocked with food (*Belonogaster* SAUSSURE, 1853 / Vespidae; *Sceliphron* KLUG, 1801 / Sphecidae). Because of their fascinating social life, ants are among the most conspicuous members of this order. They are fairly common, but easily overseen mostly living in subterranean nests under stones or other materials. There have been no endemics among the 13 species recorded so far. Despite their minute size they have an important effect on the structure and composition of the soil.

Based on the data in literature approximately 200 species of butterflies and moths flourish in the different and partly extreme environments of the Archipelago. Some of them are of quite spectacular size and beauty. About one third of the Lepidoptera are supposed to be endemics or geographical races, unique to the islands. But because of a missing modern revision of the older data, it is not possible to give exact numbers.

For most species, there is little information on their distribution, the seasonal occurrence, the rank of variations, and their biology, such as during the early stages (egg, larva, pupa), the mating season, the food plants and other aspects of ecological importance. The extend of migration is also largely unknown, and how far the strongly migrant species survive at Socotra and the other islands on a permanent basis.

Nevertheless it can be supposed, that the moths and butterflies also make up an abundant and essential source of food for a wide range of other animals on the Archipelago, and that a number of species, mainly moths, are of importance as pests, destroying, disfiguring or contaminating materials when they feed voraciously in their larval stages. The local people are not familiar with the life cycle of butterflies, and are also not very interested in them, neither in the adults, nor in the caterpillars. They use a general term for caterpillars and worm-like larvae, but seem not to distinguish them further.

The most impressive forms in size and colour can be found among the about 30 species of Rhopalocera (Figs. 90-95). Nowadays the Nymphalidae (Danainae, Nymphalinae, Acraeinae, Satyrinae etc.) include a number of forms considered to represent distinct families in the past (LARSEN 1984). A common and typical characteristic of all of them are the reduced forelegs, which are not longer used for walking. Socotra is famous for two members of the subfamily Charaxinae, the endemic *Charaxes balfouri* BUTLER, 1881 and the local race of the African *Charaxes candiope velox* GRANT, 1899. Both are easily recognized by their large, robust body and typical wings. They show a cryptic coloration on the lower surface for camouflage, while the upper surface is bold and more brightly coloured; furthermore there are short, tail-like extensions on each hind wing. I came upon *Charaxes* OCHSENHEIMER, 1816 on several occasions in February and March 1999 in the mountains of Socotra. Their manner of flight was powerful, but more erratic.

Fig. 87 Hymenoptera (next page / nächste Seite):

Top: *Belonogaster saussurei* KIRBY, 1881.

2nd left: *Sphex satanas* KOHL, 1906.

2nd right: *Xylocopa* sp.

3rd left: *Rhynchium versicolor* KIRBY, 1900.

3rd right: *Salius extraneus* KIRBY, 1903.

4th right: *Sceliphron spirifex* LINNAEUS, 1758.

Bottom left: *Apis mellifera* LINNAEUS, 1758.

Bottom right: *Chalybion bengalense* (DAHLBOM, 1845).



Fig. 88 Hymenoptera (next page / nächste Seite):

Top left: Nest of *Camponotus hova* FOREL, 1891.

Top right: *Camponotus hova*.

2nd left: *Pachycondyla sennaarensis* (MAYR, 1862).

2nd right: *Camponotus hova*.

3rd left: *Pheidole teneriffana*.

Bottom left: *Lepisiota spinisquama* (KUTZNETSOV-UGAMSKY, 1929).

Bottom right: Nest of *Lepisiota spinisquama*.

Fig. 89 Diptera and Siphonaptera (page 214 / Seite 214):

Top left: *Anopheles* sp. on a wall at Hadibo. Mosquitoes breed in open hand dug wells, watering holes or irrigation tanks and small natural depressions filled with rainwater. The greatest source of infestation is in fresh and saline water bodies along the coastal estuaries, becoming polluted with vegetation growth, bacteria and putrefying animal excreta and household refuse.

Top right: *Oestrus ovis* LINNAEUS, 1758.

2nd: Blowflies (Calliphoridae).

3rd left: Bee Fly (Bombyliidae).

Bottom left: Robberflies (Asilidae).

Bottom right: *Ctenocephalides felis strongylus* (JORDAN, 1927).

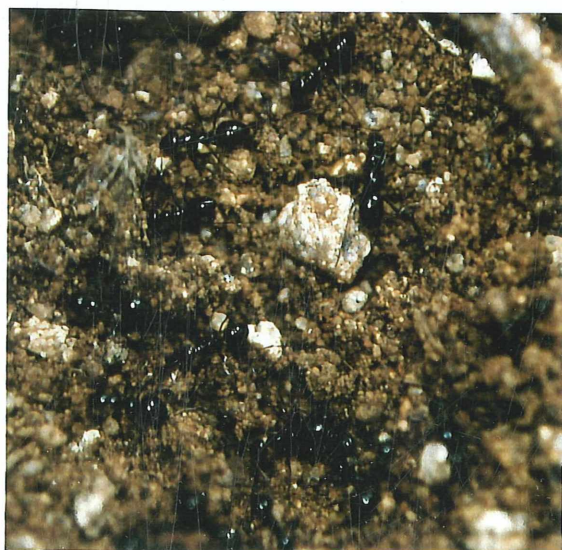






Fig. 90 Lepidoptera (previous page / vorige Seite):

Top left: *Vanessa cardui* (LINNAEUS, 1758); Diksam.

Top right: *Acraea neobule* DOUBLEDAY, 1848; Diksam.

2nd left: *Byblia anvata* boydi DIXEY, 1898; Diksam.

Middle right: *Papilio demodocus bennetti* DIXEY, 1898; at the mountains.

3rd left: *Junonia oenone* (LINNAEUS, 1758); Diksam.

Bottom left: *Cerocala socotrensis* HAMPSON, 1899 (Noctuidae); Hadibo.

Bottom right: *Utetheisa* sp. (Arctiidae); Firmihin.

We did not see them feeding, but it can be supposed, that they visit flowers only very rarely, and are more attracted to decomposed substances, such as meat, fish, dung or fruits. *C. balfouri* is supposed to occur in the forested areas of Socotra. It does not fly as rapidly as other species and when disturbed settles again soon (HENNING [1989] 1988).

The only member of the Danainae is the Plain Tiger (*Danaus chrysippus* (LINNAEUS, 1764)). It is an active migrant, widely distributed on the African and Arabian mainland, and can be seen on Socotra from the coastal plain to the mountains. *D. chrysippus* occurs in four different forms, which were originally thought to constitute different species. However breeding experiments have demonstrated, that all forms could emerge from the same batch of eggs (LARSEN 1984). The flight of this fascinating butterfly is fairly slow and erratic, but can become quite effective in case of any disturbance. Its caterpillars are luminous coloured and have several long, thread-like appendices on their backs. They feed exclusively on members of the plant family Asclepiadaceae, such as *Calotropis procera* AITON, or on its close relatives. Therefore the species of this family are popularly known as milkweed butterflies. The plants contain poisonous alkaloids, which are accumulated in the caterpillars, making them unpalatable. Because these substances are transmitted during metamorphosis, the adult stages also remain distasteful or toxic to most predators. The bright coloration of the caterpillars and the conspicuous orange wing colour of the butterfly are distinct and successful warning signals telling predators to keep away. Birds, lizards and other animals, which normally feed on butterflies, avoid them. Though *Calotropis procera* can be found in various places on Socotra, I have not seen any traces of caterpillars.

Fig. 91 Lepidoptera (next page / nächste Seite):

Top left: *Acraea neobule socotrana* REBEL, 1906 (Nymphalidae / Acraeinae); "Socotra, leg. Simony, 2.1899, Sammlung Naturhistorisches Museum Wien".

Above right: *Phalanta phalantha* (DRURY, 1773) (Nymphalidae / Nymphalinae).

2nd right: *Byblia anvata* boydi DIXEY, 1898 (Nymphalidae / Nymphalinae); "Socotra, leg. Simony, 2.1899, Sammlung Naturhistorisches Museum Wien".

Middle left: *Charaxes candiope velox* (GRANT, 1899) (Nymphalidae / Charaxinae); "Socotra, leg. Simony, 2.1899, Sammlung Naturhistorisches Museum Wien"

3rd right: *Charaxes balfouri* BUTLER, 1881 (Nymphalidae / Charaxinae); "Socotra, Ras Shoab, leg. Simony, 1.1899, Sammlung Naturhistorisches Museum Wien"

Bottom: *Hypolimnas bolina* LINNAEUS, 1764 (Nymphalidae / Nymphalinae), male (left) and female (right).

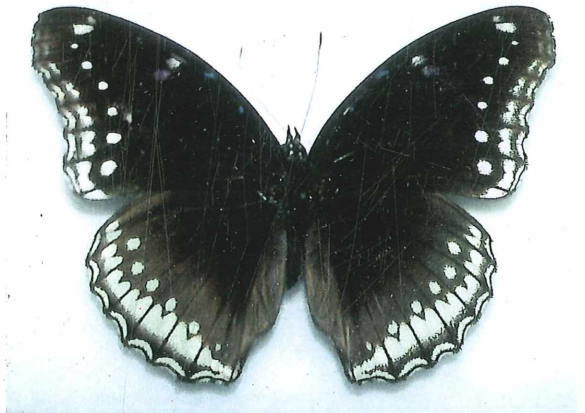
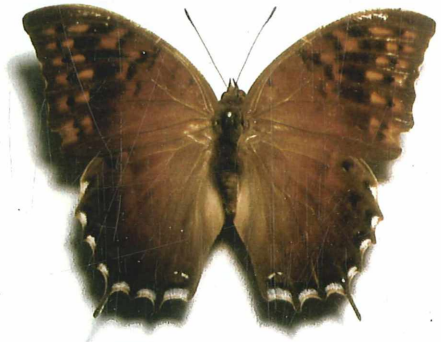
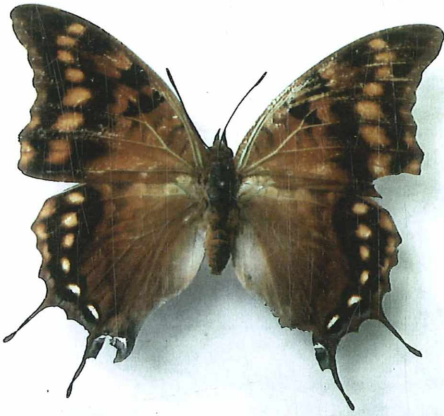
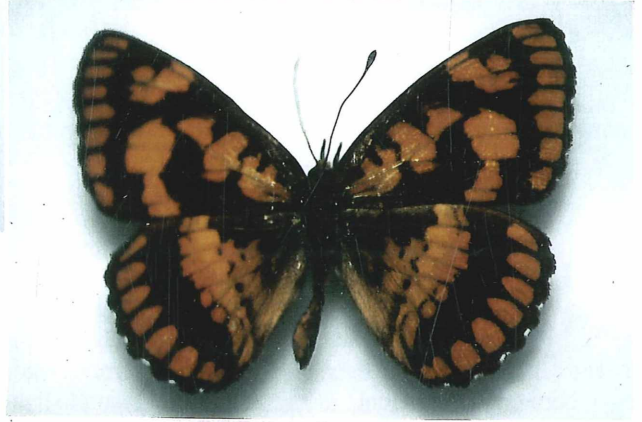
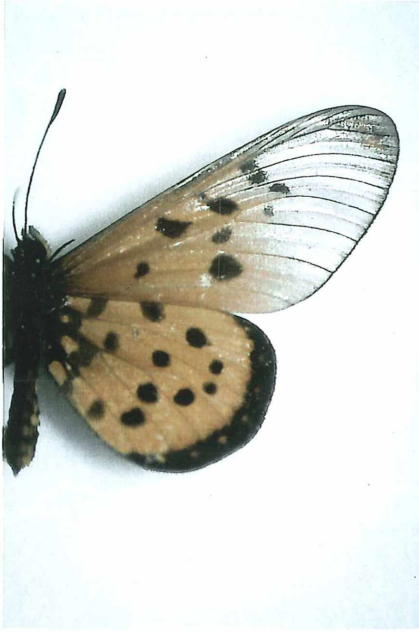


Fig. 92 Lepidoptera (next page / nächste Seite):

Top: *Hypolimnias misippus* LINNAEUS, 1767 (Nymphalidae / Nymphalinae); male (left) and female (right); "Socotra, Ras Shoab, leg. Simony, 1.1899, Sammlung Naturhistorisches Museum Wien"

2nd: *Junonia oenone* (LINNAEUS, 1758) (Nymphalidae / Nymphalinae); male (left) and female (right).

3rd left: *Junonia hierta cebrene* TRIMEN, 1870 (Nymphalidae / Nymphalinae); "Socotra, leg. Simony, 1.1899, Sammlung Naturhistorisches Museum Wien"

3rd right: *Vanessa cardui* (LINNAEUS, 1758) (Nymphalidae / Nymphalinae).

Bottom left: *Mycalesis anynana socotrana* BUTLER, 1881 (Nymphalidae / Satyrinae); "Socotra, Haghier, leg. Simony, 2.1899, Sammlung Naturhistorisches Museum Wien"

Bottom right: *Danaus chrysippus chrysippus* (LINNAEUS, 1764) (Nymphalidae / Danainae).

Another special attribute of the milkweeds or monarchs is the presence of brush-like structures in the males, which are normally concealed within the body, but extruded during courtship, when they are used to brush a pheromone onto the antennae of the female. These are, in combination with glands on the hind wings, obvious as prominent black spots. They are pouch-like in structure and hold innumerable small scales, which are presumed to have a complementary function to the pheromone. Of importance seems to be furthermore the addition of special alkaloids. But because they cannot be synthesized by the Plain Tiger, they must have been taken previously from certain plants.

Nine species belong to the subfamily Nymphalinae. Far spread in Africa and Arabia is the Diadem *Hypolimnias misippus* (LINNAEUS, 1764), which shows a distinct sexual dimorphism, making it hard to believe that both forms belong to the same species. The male has dark wings with light, oval spots, while the female equals the unpalatable Plain Tiger. It is an interesting example in which harmless animals gain protection from predators by copying unpleasant or dangerous forms marked as mimicry. The species is known to feed on a wide range of Acanthaceae. The male of the closely related Giant Egfly (*Hypolimnias bolina* (LINNAEUS, 1758)) resembles the male Diadem, while the female mimics an Asian relative of the Plain Tiger (*Euploea*). In contrast to most other Nymphalidae, which are Afrotropical, the Giant Egfly is of oriental origin. REBEL (1931) supposes that they were introduced by ship or food import from the Far East.

Orange and black are the dominant colours of the upper surfaces of the Leopard Fritillary *Phalanta phalanta* (DRURY, 1773) and the African Joker *Byblia anvatara boydi* DIXEY, 1898. The first is widespread in Africa and Asia, but the population on Socotra (*Ph. phalanta granti* ROTHSCCHILD & JORDAN) appears to be of Asian origin (LARSEN 1982). The latter occurs in Africa up to the south-western parts of Arabia; its larvae feed on Euphorbiaceae. The occurrence of *Vanessa cardui* (LINNAEUS, 1758) is no surprise, because this famous migrant is perhaps the most widespread butterfly on earth, found worldwide with the exception of the Antarctic and parts of Latin America. The Pansies are also pretty specimens. We caught the Dark Blue Pansy *Junonia oenone* (LINNAEUS, 1758) in the mountains, where the brilliantly blue butterfly was flying close to the ground. Reported is also the Yellow Pansy *Junonia hierta cebrene* TRIMEN, 1870.

Easily distinguished from all other species by the transparent wingends can be the only member of the subfamily Acraeinae, the Glass-Tip Acraea (*Acraea neobule socotrana* REBEL, 1906), which is also unpalatable to birds.

Also from the Satyrs (Satyrinae), which are grass-feeders, only one species (*Mycalesis anynana socotrana* BUTLER, 1881) has been recorded.

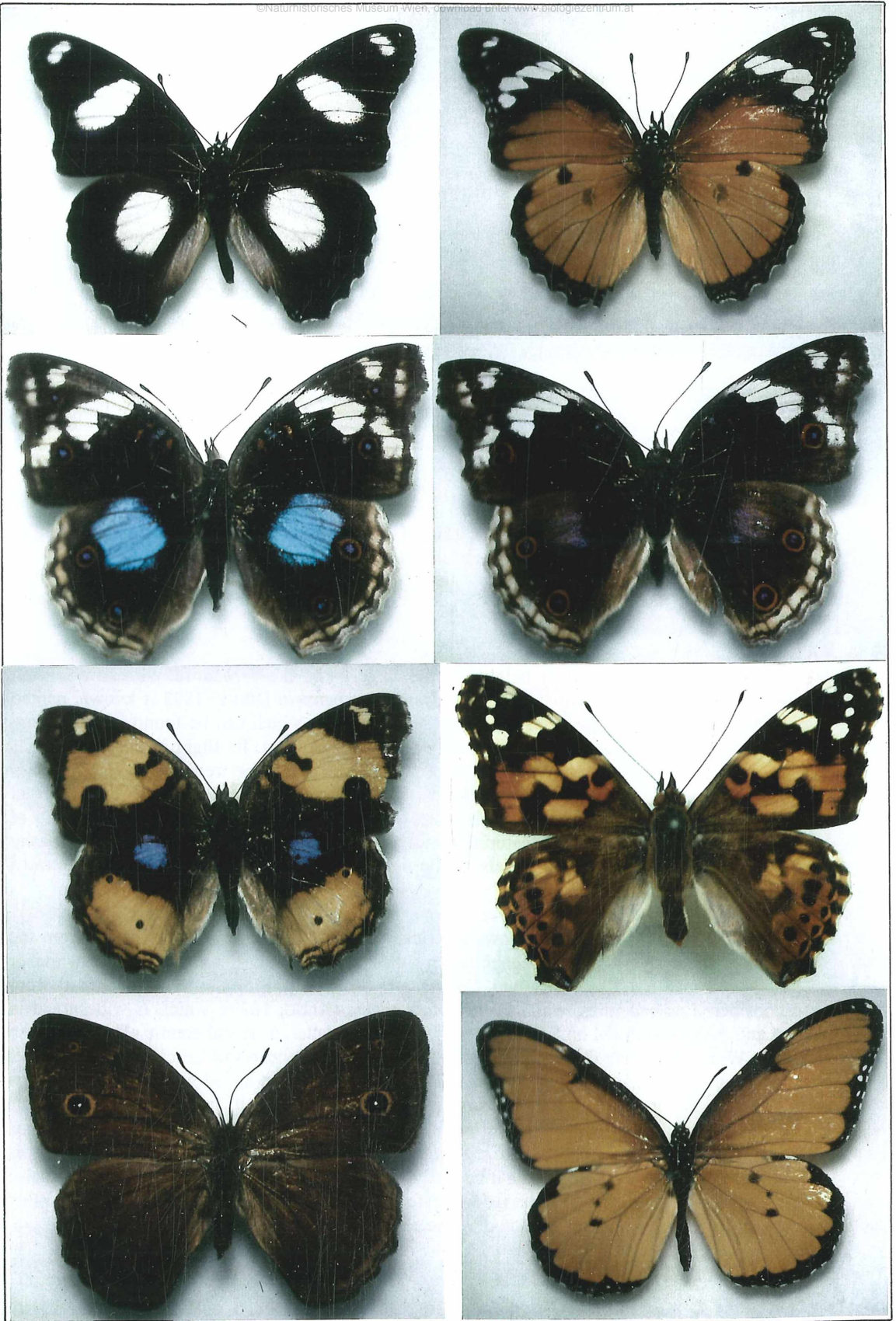


Fig. 93 Lepidoptera (next page / nächste Seite):

Top left: *Colotis evagore niveus* BUTLER, 1881 (Pieridae / Pierinae); "Socotra, Ras Shoab, leg. Simony, 1.1899, Sammlung Naturhistorisches Museum Wien"

Top right: *Belenois anomala* BUTLER, 1881 (Pieridae / Pierinae); "Socotra, Ras Shoab, leg. Simony, 1.1899, Sammlung Naturhistorisches Museum Wien"

2nd left: *Catopsilia florella* (FABRICIUS, 1775) (Pieridae / Coliadinae); "Socotra, leg. Simony, 2.1899, Sammlung Naturhistorisches Museum Wien"

2nd right: *Pontia glauconome* (KLUG, 1829) (Pieridae / Pierinae); "Samha, leg. Simony, 1.1899, Sammlung Naturhistorisches Museum Wien".

3rd left: upperside *Coeliades anchises jucunda* BUTLER, 1881 (Hesperiidae / Coeliadinae); "Socotra, Haghier, leg. Simony, 2.1899, Sammlung Naturhistorisches Museum Wien"

3rd right: *Papilio demodocus bennettii* DIXEY, 1898 (Papilionidae); "Socotra, Haghier, leg. Simony, 2.1899, Sammlung Naturhistorisches Museum Wien".

Bottom left: underside *Coeliades anchises jucunda* BUTLER, 1881 (Hesperiidae / Coeliadinae); "Socotra, Haghier, leg. Simony, 2.1899, Sammlung Naturhistorisches Museum Wien".

Bottom right: *Gegenes pumilio* HOFFMANNSEGG, 1804 (Hesperiidae / Hesperinae); "Socotra, Haghier, leg. Simony, 2.1899, Sammlung Naturhistorisches Museum Wien".

The Swallowtails (Papilionidae) belong to the largest and most beautiful butterflies. From Socotra a race of the African Lime butterfly *Papilio demodocus bennetti* DIXEY, 1898 is known, named after Bennett, who caught the first specimen in 1897. This butterfly, which can be found in Africa and parts of Arabia, seems to be restricted to the mountain region of Socotra. Its flight is fairly rapid and bouncy. Sometimes they stop on flowers to feed, but are also reported to be frequent visitors of damp areas on the ground sipping moisture and associated minerals. The caterpillars, which prefer to feed at leaves of Rutaceae, are highly distasteful to birds and other predators, and display a special feature of defence. When threatened they have repugnatorial glands just behind the head, forming a forked, fleshy orange organ that can be extruded through a slit in the prothorax giving off a bad odour, concentrated from components of the food plant.

The closely related Whites and Yellows (Pieridae) are known with only four species from the Archipelago. All of them can be easily recognized by their typical pattern, which is either white or yellow. *Belenois anomala* BUTLER, 1881 and *Colotis evagore niveus* BUTLER, 1881, recorded from Socotra, are considered as endemics, while *Pontia glauconome* (KLUG, 1829), which is widespread in parts of Africa and Asia, was found on Samha (REBEL 1931). The latter, a typical eremic element, is also known as Desert White. Its larvae feed on plants of the families Resedaceae and Cruciferae. The species is well adapted to survive under extreme arid conditions, because it can spend several years as pupa without hatching waiting for suitable breeding conditions. And after the adults hatch and mate, the eggs of the next generation can develop through the larval stages to new pupae in less than two weeks, i.e. faster than most other butterflies. The Yellow *Catopsilia florella* (FABRICIUS, 1775), the fourth species, is a powerful flyer and a strongly migrant tropical butterfly, widespread in Africa, Arabia to India, and also known as African Emigrant. Its caterpillars devour forms of *Cassia* (Leguminosae), and are often accompanied by ants, which seem to be attracted by the plant secretions of the damaged leaves.

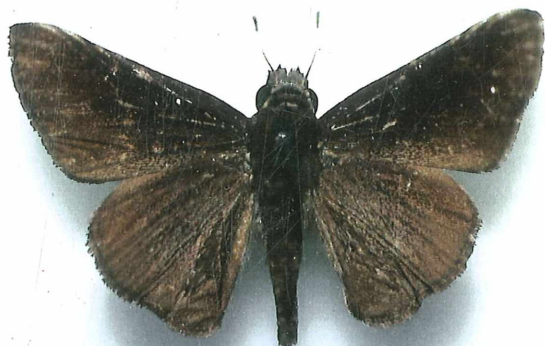
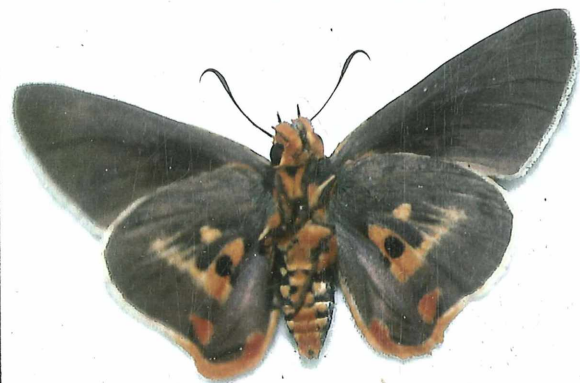
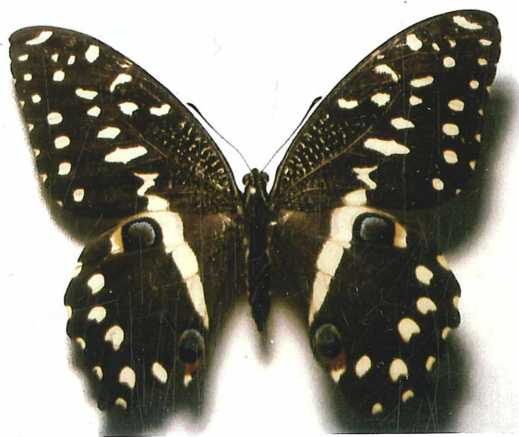
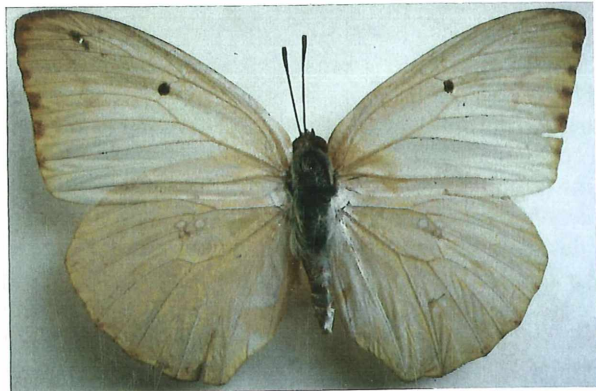
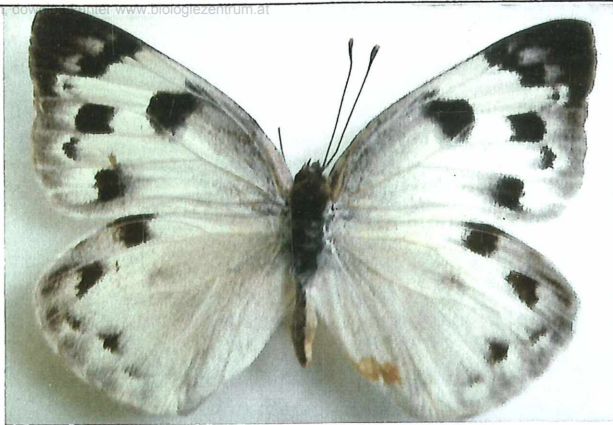
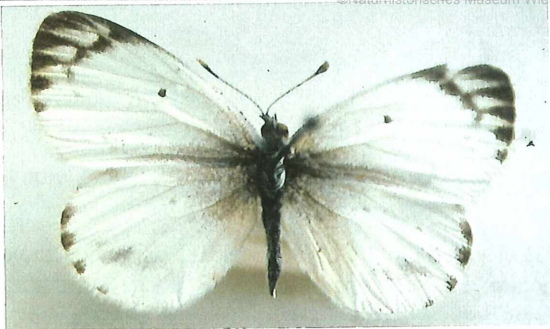


Fig. 94 Lepidoptera (Lycaenidae) (next page / nächste Seite):

Top: *Chilades trochilus* (FREYER, 1844) (Lycaenidae / Polyommatainae) upperside and underside; "Socotra, Haghier, leg. Simony, 2.1899, Sammlung Naturhistorisches Museum Wien"

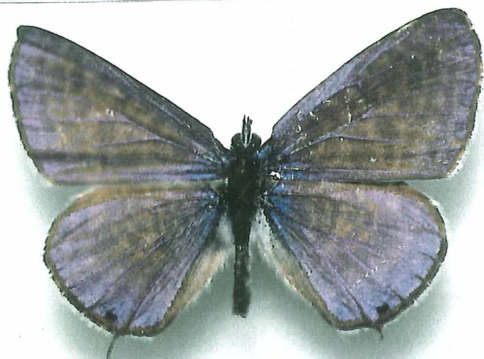
2nd & 3rd : *Leptotes socotranus* (GRANT, 1899) (Lycaenidae / Polyommatainae); "Socotra, leg. Simony, 2.1899, Sammlung Naturhistorisches Museum Wien".

4th & bottom: *Tarucus teophrastus* (FABRICIUS, 1793) (Lycaenidae / Polyommatainae) upperside male (left) & female (right), bottom underside male; "Socotra, Haghier, leg. Simony, 2.1899, Sammlung Naturhistorisches Museum Wien"

Close interrelations with ants are also known from a number of larvae of the Lycaenidae. The caterpillars of the Hairstreaks, Coppers and Blues differ considerably in habits, but some are known to produce in special glands on their abdomen a secretion which is so attractive to ants, that the small Hymenoptera will not only chase off parasites and other enemies from the caterpillars, but in some other cases will accept or even carry them to their own nests. And for the sake of the sweet secretions the ants endure the feeding on their own larvae, pupae and cocoon material. Six species of Lycaenidae have been recorded from the Archipelago, *Leptotes socotranus* (OGILVIE-GRANT, 1899) is considered as endemic. More widespread is the African Pierrot *Tarucus teophrastus* (FABRICIUS, 1793). Their food plants are species of *Zizyphus*, but the larvae are not easy to detect on the surface of the leaves because they are so well camouflaged. The African Grass Blue (*Zizeeria knysna* (TRIMEN, 1862)) and the African Babul Blue (*Azanus jesous* GUÉRIN-MENEVILLE, 1847) are known from Africa to parts of Arabia. While the larvae of the first are known to feed on alfalfa (Leguminosae), the latter are specialized on Acacia trees. African is *Cacyreus lingeus* (CRAMER, 1782), while the Gras Jewel *Freyeria trochylus* (FREYER, 1845) has a wide distribution in both the tropics and the Palaearctic Region, which indicates an ancient origin. Type locality of the species is Turkey. It is characterized by the markings on its underside, which consists of metallic green scales in red marginal spots. The food plants of its larvae are Heliotrope (Boraginaceae) and Indigo (Leguminosae).

The Skippers (Hesperiidae) are represented with two species. Most impressive is the Giant Skipper *Coeliades anchises jucunda* BUTLER, 1881. This subspecies is also known from Dhofar and Northern Oman, while the typical African subspecies also is found in Yemen. The larvae are reported to feed on *Acridocarpus socotranus* OLIVER (1868) (Malpighiaceae), rolling the leaves up like a cigar (LARSEN 1984). The second species, the Pigmy Skipper (*Gegenes pumilio* HOFFMANNSEGG, 1804) belongs to the Grass Skippers. Their larvae feed on grasses. When basking in sunshine they show the typical habit: the hindwings are fully opened, while the forewings are opened only half.

As usual in Lepidoptera, the majority of the species belongs to forms which are commonly summarized as moths (Heterocera). They are less known than the butterflies, and researching them is also more difficult. From the data in literature the Noctuidae are mostly diverse on the Archipelago with about 60 species, followed by the Pyralidae with over 40 species, and the Geometridae with about 20 species. The data of one of the big subfamilies of Noctuidae, the Hypeninae, make obvious that the recording standard of the mountain regions must be rather low. Only four species of the genus *Hypena* SCHRANK, 1802, which is widespread and rich in species throughout the African Region, are hitherto known from Socotra (LÖDL 1994, 1995, 1998): *Hypena (Hypena) obsitalis* (HÜBNER, 1813), *H. (Hypena) obacerralis* WALKER, [1859] 1858, *H. (Ophiuche) lividalis* (HÜBNER, 1790) and *H. (Jussalypena) laceratalis* WALKER, [1859] 1858. These are widespread and common species and typical for the lowland regions which are poor in species. The highest species diversity is found at high altitudes, therefore we await a considerable number of interesting species of *Hypena* from the mountains of Socotra.



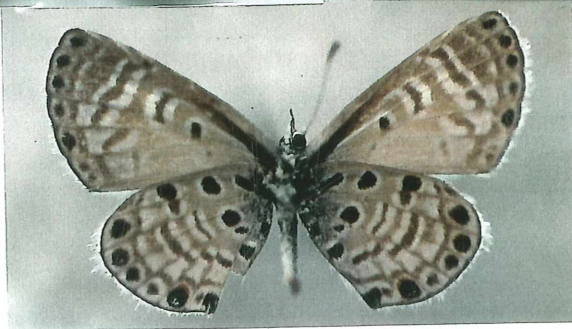
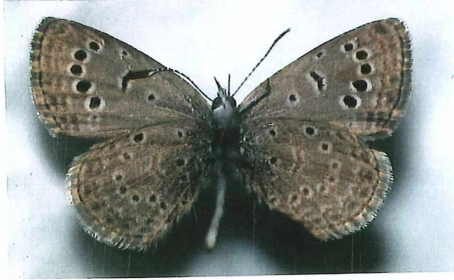
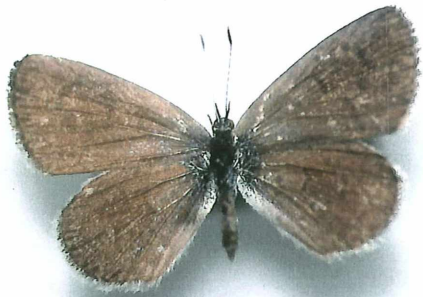


Fig. 95 Lepidoptera (Lycaenidae) (previous page / vorige Seite):

Top & 2nd: *Zizeeria knysna* (TRIMEN, 1862) (Lycaenidae / Polyommatainae) upperside male (left) & female (right), below underside male; Socotra, Haghier, leg. Simony, 2.1899, Sammlung Naturhistorisches Museum Wien.

3rd & 4th: *Azanus jesous* GUERIN-MENEVILLE, 1847 (Lycaenidae / Polyommatainae) upperside male (left) & female (right), below underside female; female Socotra, leg. Simony, 2.1899, Sammlung Naturhistorisches Museum Wien.

Bottom: *Cacyreus lingeus* (CRAMER, 1782) (Lycaenidae / Polyommatainae) upper- and underside; Socotra, leg. Simony, 2.1899, Sammlung Naturhistorisches Museum Wien.

According to REBEL (1906), who summarized the results of the Austrian expedition as well as the data of former activities, the butterflies of Socotra show the character of an oceanic island-fauna of East-Ethiopian origin. His position is based on the high endemic part of approximately 33% of the species, the absence of a number of groups and species which are widespread on the mainland, as well as the dominance of Afrotropical relations. He considers the existence of a number of relict forms, such as *Charaxes balfouri*, *Belenois anomala*, *Coeliades anchises jucunda*, *Basiothia socotrensis* REBEL, 1906, *Pseudomicra decolor* REBEL, 1906, and also the low species number of Pieridae, as an indication of the long period of isolation of Socotra.

Widespread and common are centipedes (Chilopoda), but lacking a water protecting wax layer to the cuticle they are nocturnal, spending their day in damp, dark places under stones or in crevices. The local people know very well that the carnivorous specimens are poisonous and therefore they are mainly afraid of the larger scolopenders. But they are not familiar with the exact location of the poisonous glands in the claws of the mouth parts and overestimate, like many other people, the importance of the enlarged, pincer-like acting last pair of walking legs. Also in centipedes the venom is not fatal to man, but causes considerable pain usually accompanied by swelling of the affected area. About seven species of centipedes have been recorded. But like in most groups known from the archipelago, there is a number of systematic problems still unsolved, such as the question, whether the large scolopenders belong to only one variable or to two very similar species (*Scolopendra balfouri* POCKOCK, 1903; *S. valida* LUCAS, 1840). And besides this, there are also still undescribed forms, such as at least one member of the Scutigermorpha, which are characterized by 15 pairs of exceedingly long legs and the possession of compound eyes. We found a few specimens of these very agile forms in the mountains. Further studies are also necessary for the millipedes (Diplopoda), such as the state of the three species of the genus *Fontariopsis* POCKOCK, 1903 and a first record of a *Siphonophora* BRANDT, 1837 in 1999.

The only known poisonous terrestrial species besides centipedes seem to be scorpions and spiders (Figs. 97-101). At least five species of scorpions are known from the Archipelago. Two belong to the Family Buthidae, the relatively large and most common yellowish *Hottentotta socotrensis* (POCKOCK, 1889) (recorded from Socotra and Samha), and the dark coloured, quite rare *Orthochirus bicolor insularis* (POCKOCK, 1889) (Socotra). Widespread on Socotra is the brownish *Hemiscorpius socotranus* POCKOCK, 1889, while the lighter specimens from Samha and Darsa need further studies to clarify their state. The remaining two taxa belong to the Family Diplocentridae (*Heteronebo forbesii* POCKOCK, 1889; *H. granti* POCKOCK, 1889), and were supposed to be restricted to Abd al Kuri. But during the last expedition we also found a *Heteronebo*-species on Socotra. It is a small genus, but of great taxonomic and zoogeographical interest, because it has a peculiar distribution, with the two or three taxa on the Archipelago, and further six species on Caribbean islands. Scorpions are nocturnal predators locating their prey principally by the sense of touch, eating chiefly insects and spiders, but they are also cannibalistic. They are common under stones in all parts of the island and are usually killed if discovered by chance. There has been no investigation on the venom of the five species, however it does not seem to be fatal to man, although it is painful.



Fig. 96 Chilopoda and Diplopoda (previous page / vorige Seite):

Top & 2nd left: *Scolopendra valida* LUCAS, 1840 (Chilopoda / Scolopendridae).

POCOCK (1903b) distinguished two very similar species, the smaller *S. valida* (length up to about 80 mm) and the larger *S. balfouri* (total length up to 180 mm), both occurring on Sokotra. Later authorities have synonymized them but the variability in *S. valida* suggests that it is a possibility that should not be totally dismissed.

S. valida has been recorded from the Canary Islands, Cameroun, Sudan, Syria and Saudi Arabia.

Middle right: Head and first tergites of *Mecistocephalus insularis* (H. LUCAS, 1863) (Chilopoda / Mecistocephalidae). The species is widely distributed in Africa, India, China and South-East Asia. Total length up to about 90 mm.

3rd left: *Rhysida longicornis* POCOCK, 1891 (Chilopoda/Scolopendridae). Length up to about 55 mm.

Bottom left: *Fontariopsis* sp. (Diplopoda / Oxydesmidae).

POCOCK (1903b) distinguished three endemic species, but further studies are necessary to verify their status.

Bottom right: Scutigeridae, not yet identified. It is difficult to obtain complete specimens of these nocturnal centipedes, as they are fast running and shed their legs when seized.

The Solifugae, or camel spiders, have an impressive appearance with their huge jaws and leg-like pedipalps, but they are harmless. There is one endemic species (*Gluviopsis balfouri* (POCOCK, 1889)) known from Socotra, Samha and Abd al Kuri. The relatively small, grey to yellow brown specimens are nocturnal, but can sometimes be found underneath stones and are able to run with great speed. The endemic harvestman *Hinzuanus flaviventris* (POCOCK, 1903) (Opiliones) is conspicuous in reddish colour of the short round-body and the comparatively long legs. Strange looking Pedipalpi were recorded in caves, while the minute Pseudoscorpiones were found under stones or the bark of trees.

The true spiders (Araneae) show a variety of interesting and impressive species, but have been studied comparatively little. In general, people on the island have no aversion against spiders, because of the important part that these web weaving creatures played in hiding the prophet Mohammed on his flight; with exception of some species, such as the large *Monocentropus balfouri* POCOCK, 1897 (Theraphosidae), which can be found burrowing under stones. Most people consider it as very dangerous and aggressive, with a bite even to kill a dromedary. However this is not only an overestimation of its real toxicity, which does not depend on the size of a spider, but also a wrong interpretation of a typical behaviour of disturbed specimens. The position of the animal with its lifted front legs, drawn as attack (FORBES 1903), is nothing more than a typical behaviour of defence. Fairly common under stones in the mountains are wolf spiders (Lycosidae) hunting down their prey instead of making webs and carrying the eggs in a silk cocoon beneath the abdomen. Attention should be paid to the Theridiidae, which are common and present with various species (we recorded *Latrodectus geometricus* C.L.KOCH, 1841, *Latrodectus hystrix* SIMON, 1890). Some of them are known to be dangerous to man. Frequently one meets with webs of spiders placed in or between bushes. In higher altitudes relatively common are the large *Argiope sector* (FORSKAL, 1775) and *Nephila sumptuosa* GERSTÄCKER, 1873, as well as the small, but strange looking *Gasteracantha sanguinolenta* C.L. KOCH, 1845, which is highly variable in colour.

Completed are the arachnids by the parasitic mites and ticks (Acarida). We took two species of Ixodidae (*Hyalomma truncatum* KOCH, 1844; *Boophilus annulatus* (SAY, 1821)), which are both known as transmitters of disease from the anal area of cattle and goats. Red velvet Mites (*Dinothrombium* sp.) were recorded in numbers in autumn 1998. While the adults are free living, the larvae of these Trombidiidae are parasitic on grasshoppers and lizards. The bright red colour has an aposematic function, serving to warn potential predators of its unpalatability. There also seem to be widespread itch-mite infections (*Sarcoptes scabiei*) among the people.

Fig. 97 Arachnida (next page / nächste Seite):**Top left:** *Hottentotta socotrensis* (POCOCK, 1889) (Scorpiones).

The yellowish endemic scorpions are widespread and common on Socotra, they can be found from the coastal plain up to the mountains. It was also recorded on Samha. The genus *Hottentotta* is widespread, with representatives in Africa, the Middle East, and parts of southern Asia.

Top right: *Orthochirus bicolor insularis* (POCOCK, 1899) (Scorpiones).

The dark scorpion seems to be rare. The specimen on the photo was recorded at Diksam. The photo shows the punctate metasomal segment V that characterizes the genus, which has a wide distribution, similar to that of *Hottentotta*. *O. bicolor* has three subspecies that occur in India, Pakistan, and Afghanistan. The form on Socotra needs further studies to clarify, if it has a separate species status.

Middle left & 2nd right: *Hemiscorpius socotranus* POCOCK, 1899 (Scorpiones).

This smaller, endemic scorpion is widespread and common. It was recorded from Socotra (middle left) and Samha (right). However the specimens from Samha, which show some differences to the specimens from Socotra, need further studies to clarify their status. The genus has four other species, distributed on the Arabian Peninsula and in southwestern Asia.

3rd right: *Heteronebo* sp. (Scorpiones).

The genus *Heteronebo* is quite curious, with two species on Abd al Kuri (*H. forbesii* POCOCK, 1899; *H. granti* POCOCK, 1899) and about a dozen on the Caribbean Islands. In terms of external morphology, they are apparently indistinguishable at the generic level.

A young *Heteronebo* was recorded for the first time on Socotra in autumn 1998.

Further studies are necessary to prove their status within the diplocentrids and the distribution on the archipelago.

Bottom left: *Hinzuanus flaviventris* (POCOCK, 1903) (Opiliones).

The brown and reddish-yellow specimens were found under stones on Socotra and Abd al Kuri. Their movement is slow and deliberate.

Bottom right: *Gluiopsis balfouri* (POCOCK, 1895) (Solifugae).

The pale yellow species (total length about 16 mm) was recorded on Socotra and Samha.

Land and freshwater crustaceans are represented with some very interesting taxa. The land crab *Cardisoma carnifex* (HERBST, 1796) (Gecarcinidae), which is widespread on the mainland too, was found on the coastal plain at Socotra in mangroves and beside estuaries, there usually in the vicinity of date palm trees. The ground of their burrows in the soil is filled with water, in which the huge, omnivore specimens escape in case of danger (Fig. 102).

Very common in the fresh water areas, mainly the numerous, mostly sporadic streams of the mountains, is the reddish endemic fresh water crab *Potamon socotrensis* (HILGENDORF, 1883) (carapace breadth up to 39 mm) (Fig. 103). But in 1997 we discovered a second species which seems to be restricted to certain parts of the mountainous limestone plateau, at least around Diksam (Fig. 104). These crabs are larger in size, with a carapace breadth of the female of about 9 cm. They are mainly nocturnal, wandering around and climbing on rocks during the night. During the day they usually hide in the complex system of small limestone cavities, which are at least temporarily filled with rainwater and might have a permanent water layer in their deeper parts. It seems that the crabs also retreat deeper in these cavity systems to overcome periods drought, and it is probably also the place for reproduction, because we observed and recorded a number of young crabs at the entrance to this labyrinth.



Fig. 98 Arachnida (next page / nächste Seite):

Not much notice has been taken so far of the small Acari and Pseudoscorpiones, although livestock seems to be greatly infested by ticks. Both recorded species are known from other regions because of medical and veterinary importance.

Top left: Goat infested with *Boophilus annulatus*, Diksam.

Top right: *Boophilus annulatus* (SAY, 1821) (Acari / Ixodidae), Diksam.

2nd, 3rd & bottom left: A gecko and a cricket hosting trombiculid mite larvae. *Trombidium* sp. (Acari), Diasma.

Middle right: *Hyalomma truncatum* KOCH, 1844 (Acari / Ixodidae); Diksam.

Bottom right: Pseudoscorpiones, not yet identified, Homhil.

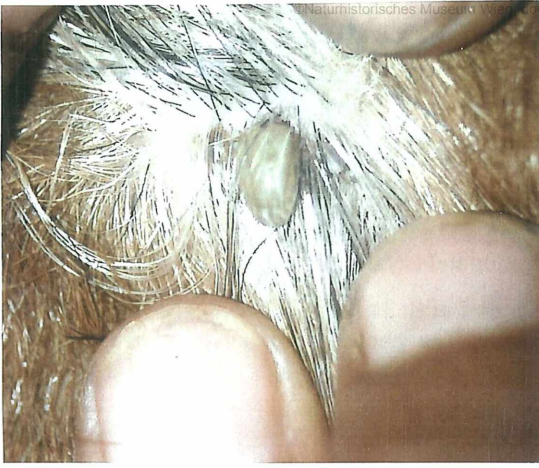


Fig. 99 Arachnida (next page / nächste Seite):

The true spider fauna (Araneae) seems to be much more diverse than it is known from the available data.

Top: *Monocentropus balfouri* (POCOCK, 1897) (Araneae / Theraphosidae).

It is the most impressive spider on the island, because a fully developed specimen has a size of almost a palm with extended legs. The endemic species is burrowing and seems to be restricted to Socotra Island. The body has a dark brown colour, with the base of the femur and trochanters greyish-white or reddish.

The figure on the left shows *M. balfouri* in a typical position of defence (from FORBES 1903), which is mistaken by the local people for an aggressive behaviour. The photo on the right (above) shows a „typical“ coloured specimen, recorded at Homhil. The photo below shows a specimen (recorded by van Damme in February 1999) which is different in colour. Further studies will clarify, if these are only variations within one species, or if there is more than one Socotran tarantula.

Middle: *Pardosa* cf. *spilota* POCOCK, 1903 (Araneae / Lycosidae); Diksam.

Wolf spiders are found under stones from the plain up to the mountains.

Bottom left: *Latrodectus* sp. (Araneae / Theridiidae); Diksam.

Spiders of the genus *Latrodectus* are rather common on Socotra. There seem to be at least three to four different species. However, it is a difficult group taxonomically and therefore further studies are necessary to clarify the species structure, and in this connection also the medical importance of the Socotran forms.

Bottom right: *Selenops* sp. (Araneae / Selenopidae); Hadibo.



Fig. 100 Arachnida (next page / nächste Seite):

Top: *Gasteracantha sanguinolenta* C.L. KOCH, 1845.

This strange looking small spider is common on most of the higher bush-glad ground. It is variable in colour, and no two individuals appear to be exactly alike. The net is usually placed in bushes. The sexes show distinct differences in size and shape (middle left).

Bottom left: *Argiope sector* (FORSKAL, 1775) (Araneae / Araneidae).

A female specimen, Diksam.

Bottom right: *Nephila sumptuosa* GERSTÄCKER, 1873 (Araneae / Tetragnathidae); Hasaant.

This large, handsome coloured spider forms great, impressive webs with a strong texture.

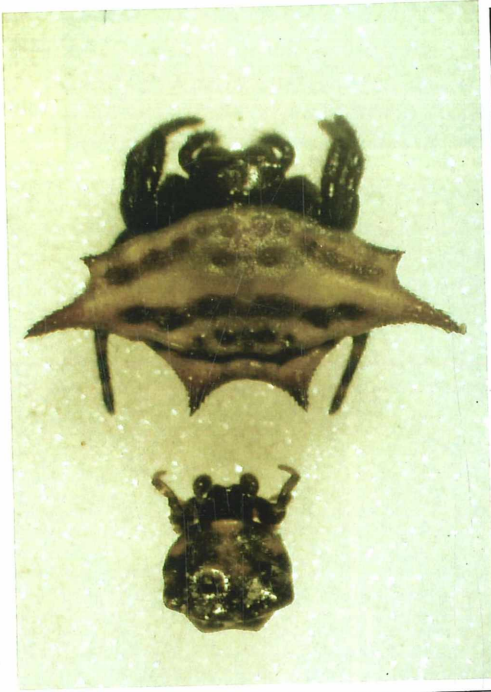
Fig. 101 Arachnida (page 236 / Seite 236):

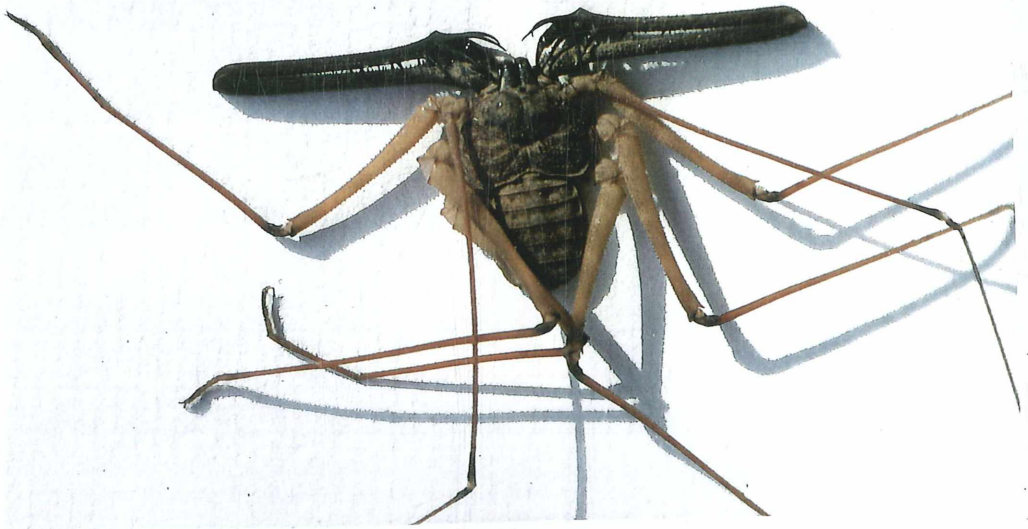
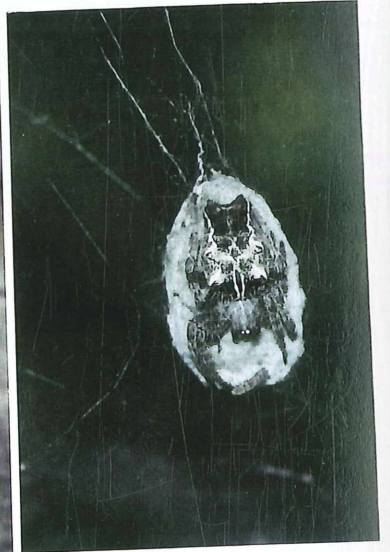
Top: A species of Pholcidae, Diksam. Not yet identified.

Middle left: *Tetragnatha* sp. (Araneae / Tetragnathidae) recorded in the surrounding of a stream, Diksam.

Middle right: *Cyrtophora citricola* (FORSKAL, 1775), Homhil.

Bottom: A Pedipalpi (Amblypygi), recorded in February 1999 by van Damme, not yet identified species of the genus *Phrynichus* KARSCH, 1879.





The large size of the specimens, together with their preference for the arid highland region of the island of Socotra, and their striking superficial resemblance to the land crab genus *Cardisoma* (Grapsoidea, Gecarcinidae), raises questions about a possible relationship of the new taxon with the gecarcinids. However, a number of characters clearly indicate that the highland specimens are true freshwater crabs (Potamoidea) rather than land crabs (Gecarcinidae). There is at least a third species of freshwater crab, which is similar in appearance to *P. socotrensis*. It lives in a waterfall area in the western part of the Naged plain.

All species of freshwater crabs of Socotra are endemic and both show affinities with the Potamidae, a freshwater crab family with a wide distributional range that includes northwest Africa, southeast Europe, the Middle East, the Himalayas, Southeast Asia, and China. Perhaps surprisingly, given the close proximity of the island to the coast of Africa, the Socotran freshwater crabs were not found to be closely related to the freshwater crabs families found in East Africa (Potamonautidae and Deckeniidae).

No traces of the presence of freshwater crabs have been found on the other islands of the Socotra Archipelago. The conditions for inland crabs on Abd al Kuri are even more extreme than on Socotra, because there is little surface water, and it tends to be brackish. Most of Samha is barren with only a few freshwater depots, while the smaller Darsa seems to have no available freshwater.

Wood-lice are not uncommon, especially in the mountains, but by lack of a water-proofed cuticle they need a moist environment and therefore they are usually under stones by day. Only two species of wood-lice (Isopoda), both endemic, have been described from Socotra, but further species have been recorded already, such as members of the amphibious genus *Ligia*, so that the number of species will increase soon to about thirty (TAITI, pers. inform.) (Fig. 103).

Fascinating among the invertebrates is also the malacofauna, because the land snails underwent a spectacular process of speciation and adaptive radiation at the Archipelago (Figs. 105-106). And as a result they show not only a surprising diversity in general shape of the shell, in colour and size, but also distinct adaptations to certain habitats in dependence upon the altitude, vegetation, moisture, substrate and other factors of ecological importance.

Shells are widespread and commonly found, but most are empty. It seems that the land snails confine their activity to those periods of the year when there is sufficient moisture, while they overcome extreme periods in a state of suspended animation remaining inactive underground, under rocks or attached to the bark of trees. During these phases of dormant state they slow all life processes considerably and have an increased resistance to unfavourable conditions like heat and drought.

In the diverse class of Gastropoda the two subclasses Prosobranchia and Pulmonata have independently evolved from sea dwellers into terrestrial snails, both with the ability of breathing atmospheric air and producing offspring ovoparously, independently of water. However, Pulmonata have been the more successful terrestrial colonists of the two.

Fig. 102 Crustacea (next page / nächste Seite):

At present only two species of terrestrial isopods are known from the archipelago. However this number will increase in a near future because of the results of the records during the mission in March 1999.

Top left: *Dioscoridillo melanoleucos* FERRARA & TAITI, 1996.

Top right: *Socotroniscus sacciformis* FERRARA & TAITI, 1996.

Middle: An amphibian living form of the genus *Ligia*, not yet identified.

Bottom: *Cardisoma carnifex* (HERBST, 1796) (Grapsoidea, Gecarcinidae), habitat with caves in the ground (edge of an estuary near Hadibo) and male specimens, Gubbah (above) and Hadibo (below).

The landcrab *Cardisoma carnifex* was recorded at Hadibo, Gubbah and the mangrove near Ras Shoab. The female crabs produce larvae that develop in seawater which limits the distribution of this species to the coastal areas.

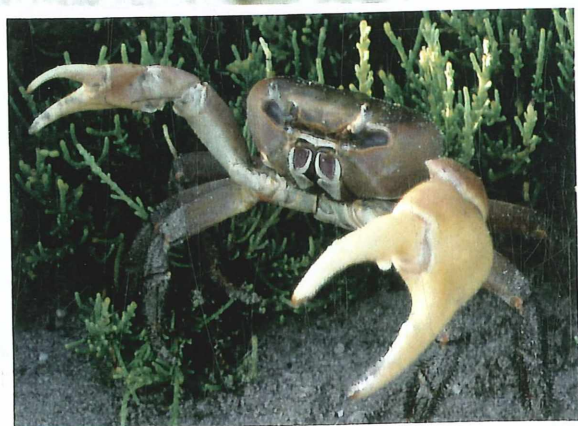




Fig. 103 Crustacea (previous page / vorige Seite):

Potamon socotrensis (HILGENDORF, 1883) (Potamidae).

The species is widespread throughout Socotra and common in suitable aquatic habitats. FORBES (1903) recorded the crab from the sea-level up to the mountains. The lowest altitude where we recorded specimens was about 100 m. They are highly variable in colour (from reddish to dark purple) and live in and near the surface water areas. The width of the carapace of the largest specimen we recorded was about 39 mm.

Top: Stream in the mountains with *Potamon socotrensis*.

2nd: Specimens of *Potamon socotrensis*.

3rd left & bottom: A female carrying young crabs under its abdomen. In one case in September 1998, 93 young crabs were counted. The photo below shows a young crab released from the maternal abdominal brood pouch.

Bottom right: A crab feeding on a crab exuvia. The diet of the crabs seems to be wide, they use algae as well as rests of dead insects or other forms of detritus. Very often they also attack each other.

On the archipelago, about one third of the distinguished about almost 70 species of Land- and Freshwater gastropods belong to the Prosobranchia, which is a relatively high number. They are not bisexual, and on the top of their foot they bear an operculum. It serves as protection against enemies and closes the shell quite well to prevent dehydration. Therefore operculate shells are also more common in the dryer plain areas. Their eyes are at the base of the tentacles. The larger *Otopoma* are reported to be eaten occasionally by the mountain dwellers.

The members of the Pulmonata are bisexual, and the majority lacks opercula. Most successful among the Pulmonata are the members of the Stylommatophora, so also on Socotra. Most Pulmonates have their eyes at the tips of retractable tentacles. Frequently on the bark of trees or on rocks are clumps of ovate, fusiform species of the diverse genus *Achatellionides*. They have closed their aperture with a mucus shield to overcome dry periods. Impressive are also the huge *Riebeckia sokotrana* (MARTENS, 1881) which can grow to 90 mm. To overcome dry periods they bury in the ground or use crevices in the rocks.

Among land snails, the degree of endemism seems to be not only 100 %, but the species structure differs also from one island to the other, with a correspondence only on the generic level. Socotra Island has the greatest diversity based on its size, the variety of habitats and an altitude of about 1500 m.

But because most species were described around the end of the 19th century, mainly based on a more or less great number of shells only, there is an urgent need for an actual revision. The small base of data also does not allow an assessment of the state of the species, which seems to be in part rather restricted in their distribution. Risk factors for the snails are human activities, such as road building or wood collection, but first of all the alter of the vegetation by grazing of livestock. Nothing is known about natural predators, such as birds, reptiles, large centipedes as well as rats, but on several occasions broken shells were found indicating such a predation.

The freshwater molluscs are much less diverse with about eight species only. No traces of Bivalvia have been found so far.

No further details are available on all groups of worm-like invertebrates, such as leeches, earthworms, nematodes or turbellarians, which are present on the island and have been already recorded in a number of specimens (FORBES 1903; WRANIK et al. 1986). Exciting discoveries promise also further studies of minute freshwater organisms, such as rotifers, anostracans, cladocerans, copepods and ostracods, and particularly the fauna of the cave systems and the interstitial waters, as indicated by a number of new blind species, as recorded by the Belgium specialist Kay van Damme in 1999 (VAN DAMME, pers. inform.).



Fig. 104 Crustacea (previous page / vorige Seite):

The unusual combination of characters of the specimens warrants the establishment of a new genus (*Socotra*) to accommodate the new species (*Socotra pseudocardisoma*, CUMBERLIDGE & WRANIK, in press).

The new species is a crab with terrestrial habits whose behavioural pattern is influenced by changes in the seasons. It seems to be restricted to those parts of the island where limestone is dominant, and where climatic erosion of the calcareous substratum has produced numerous small caves, hollows and crevices. These temporary aquatic freshwater habitats are located far from conventional freshwater sources (rivers, streams and lakes) and are fed mainly by rainwater. It is possible that there are year-round, more permanent, water deposits deep below the surface, which could also be accessed by these crabs.

S. pseudocardisoma is not easy to find, because the crabs spend most of the daylight hours concealed from view. Specimens appear only occasionally on the surface, and startled crabs quickly retreat back into the crevice system. They can move rapidly on the ground, and can climb agilely and rapidly up and down rock surfaces. During the night, crabs leave their resting-places and wander on the surface in search of food. We are unsure of the natural diet of *S. pseudocardisoma* in its natural habitat, but specimens kept in captivity ate plant material and dead animal material.

There are distinct seasonal differences in the behavior patterns of *S. pseudocardisoma*. Crabs were observed to be active only in October and November, and it is thought likely that they are active on the surface mainly during the wet season (November to March). It is possible that crabs mostly remain in their underground retreats during the drier times of the year (April to October). People who live on the limestone plateau near to the type locality and who occasionally use these crabs as food, also report a similar seasonal pattern of wet season activity, dry season disappearance.

We have only basic information on the reproduction and life cycle of this species. Five free-living juvenile crabs (carapace breadth 26 to 27 mm) already released from the maternal abdominal brood pouch were caught in summer 1998. It would appear that the production of eggs and release of hatchling crabs is timed to coincide with the wettest part of the year, when presumably plant and animal populations on Socotra are at their maxima.

Top & middle left: Habitat of *S. pseudocardisoma* with system of limestone crevices and entrance in a crevice with the traces of crabs.

Top right: Male specimen of *S. pseudocardisoma* climbing on a rock in the highlands of Socotra.

Middle right: Comparison between a young *S. pseudocardisoma* and an adult *Potamon socotrensis*.

Bottom left: In captivity, mating was observed between a hard-shelled female and a hard-shelled male who remained in the copulatory position and/or a postmating embrace for about one day, before resuming normal behaviour. The sperm was presumably stored in the spermatheca of the female for later use in the fertilisation of the eggs when they are eventually laid.

Bottom right: Adult specimens of *S. pseudocardisoma* (above) are considerably larger than adults of *P. socotrensis* (below). The largest specimen of *Potamon socotrensis* which we recorded had a carapace breadth of 39 mm, while in *S. pseudocardisoma* it was up to 90 mm.



Fig. 105 Gastropoda (previous page / vorige Seite):

The land snails of Socotra are of special interest, because of their degree of endemism, which seems to be 100 %, and the extensive endemic radiation. Three major families are represented: the Pomatiasidae, the Cerastidae and the Subulinidae.

Top & middle left: *Otopoma* sp. (Pomatiasidae) extended from the shell and with calcareous operculum. The eyes are, as typical in Prosobranchia, at the base of the tentacles.

Middle right: Head and foot of *Lithidion* sp. (Pomatiasidae) (Samha), another Prosobranchia.

Bottom right: The Pulmonate *Riebeckia sokotrana* (MARTENS, 1881) (Subulinidae), which can grow to 90 mm.

Bottom left: A small snail from Abd al Kuri, not yet identified.

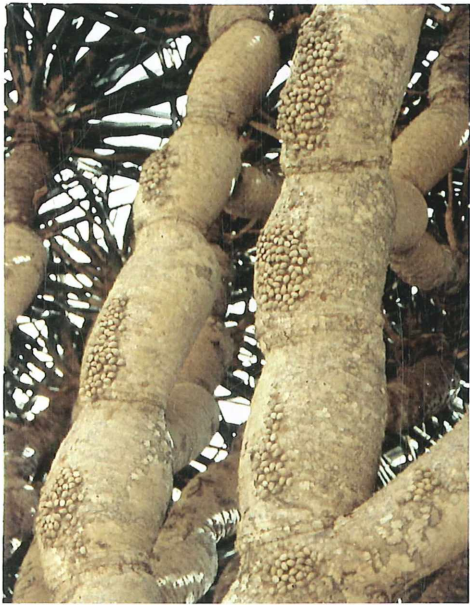
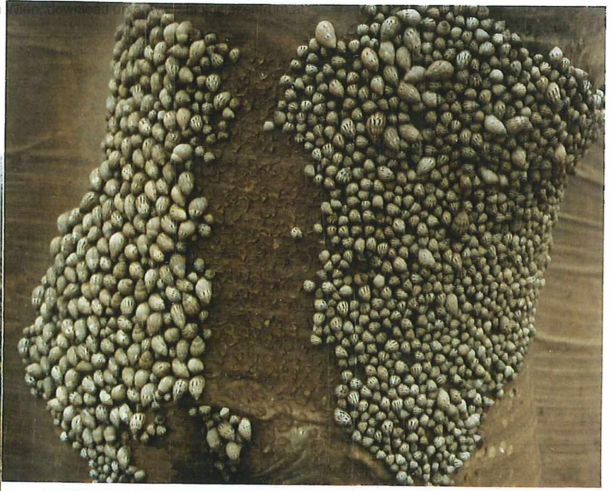
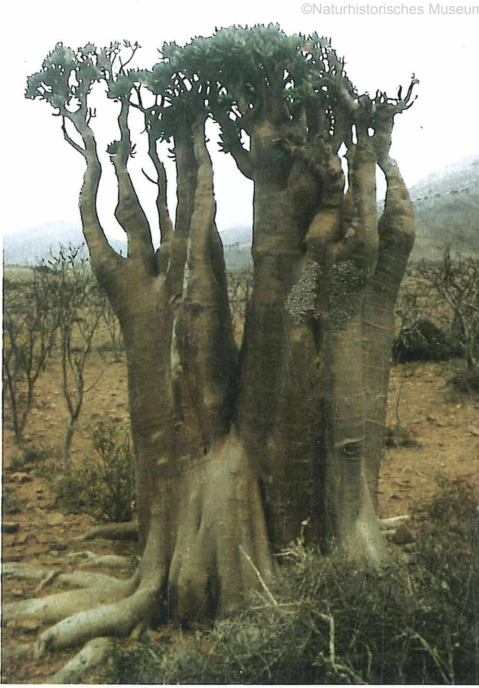
Fig. 106 Gastropoda (next page / nächste Seite):

Top left: A large colony of snails (Cerastidae) aestivating on the stem of *Adenium*.

Top right: Colony enlarged. Below: Living specimen of *Achatinelloides* cf. *socotrensis* (PFEIFFER, 1845).

Middle left: Forms of *Achatinelloides* aestivating on the bark of *Dracaena cinnabari*.

Bottom: A group of aestivating snails near Hadibo and a living specimen of *Achatinelloides hadibuensis* (GODWIN-AUSTEN, 1881) (Cerastidae). As typical for Stylommatophorans land snails the eyes are at the tips of the tentacles.



The coastal waters of the Archipelago play a role as a haven for cetaceans, sea turtle species and a wide variety of fishes and marine invertebrates. But also the marine environment of the Archipelago is still poorly described, because little scientific study has been done on the flora and fauna of the sea.

The main coastal habitats are rocky cliffs, rock cobble beaches and sand beaches, sometimes continuations of more than 100 m high sand dunes or extended storm berm running parallel to the shore. Some shorelines are gravel, characterized by alluvial matter washed down wadis from the mountains during flash floods. Mangrove (*Avicennia marina* (FORSKAL) VIERHAPPER (1907)) occur as small narrow belts and patches along inlets on the south-west coast and parts of the western half of the north coast with very tall trees, standing up to almost 8 to 10 metres high. But in comparison to the zones marked as mangrove on older maps a greater number of areas seems to be already destroyed. A number of estuaries complete the picture of the coastal area (Figs. 4-5).

The sublittoral zone is composed of sand scoured shallow rock and cobble/rubble and supports a rich macroalgal flora. Coral is widespread through the Archipelago, but the existing data are still insufficient (Fig. 107). SCHEER (1964) visited Abd-el-Kuri and found it, surrounded by steep slopes, unsuitable for reef development. He described scattered corals (9 genera) interspersed with algal dominated communities. LATYPOV (1987) speaks of coral assemblages which are at the middle stage of development of reefs. He found a distinct zonality and a relatively high species diversity of Scleractinia (67 species). Although there are no large reefs, the archipelago has a number of areas of rich coral growth.

Despite the vicinity of the larger settlements, the beaches of Socotra are astonishing clean. This is substantially caused by the fast turnover of sand, carrying litter and pollution from the beaches away to the sea. But strong summer storms seem to be also rather abrasive that the ground of shallow sublittoral areas is scoured by the sediment-laden water.

Even if not officially quantified, the shelf area of the Archipelago is reported to be rich in fish, both pelagic and demersal. In comparison with the relatively low agricultural potential of the land side forms, the marine life there is a substantial biological resource for a further development (Fig. 110). The basis of commercial fisheries form tunas, kingfish, sharks, groupers and snappers. Fishing is mostly carried out from small boats. Therefore the main season is from September to May, when the sea is calm enough to go out to sea. Meanwhile the traditional wooden *hour*i have been replaced by fibreglass skiffs. Fish are caught either with net or seine, which consists of ropes, floats and hooks. Brought to the surface, larger fish, especially sharks, are killed with a spear or a harpoon. They are salted, dried and sold on the mainland. In shallow waters often small sinker-weighted nets are used. At present, in lack of sufficient official regulations from the mainland, a relatively effective traditional fisheries management system has evolved. There are local regulations, such as rules on gear usage, fishing rights or timing, which are widely accepted and re-evaluated on a seasonal basis.

Shark fishing seems to be the only type of fishing to be currently threatened. Because of its importance, a further decline may have greater socio-economic consequences. But the disappearance of sharks, which are predators on the top of the food chain, may also lead to various ecological impacts.

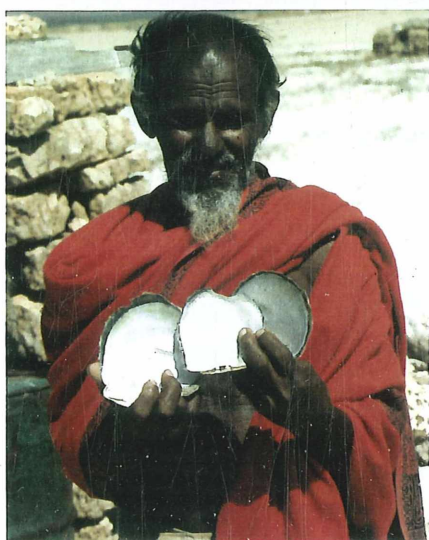
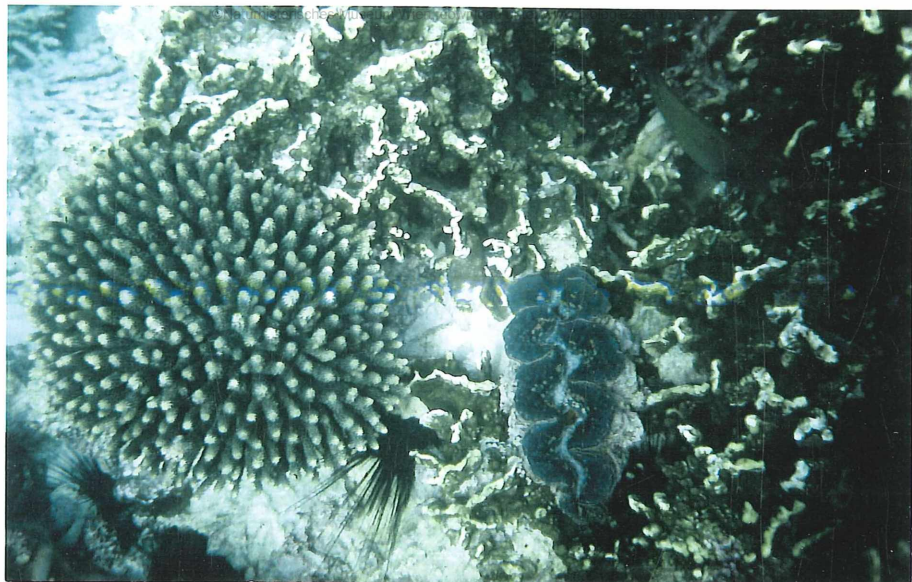
Fig. 107 Marine biota (next page / nächste Seite):

Top: Coral assemblage with the giant bivalve *Tridacna maxima* (RÖDING, 1798) (Bivalvia / Tridacnidae) in the waters east of Hadibo.

Middle: Corals of the genus *Acropora* OKEN, 1815, which are widespread in the waters of the archipelago (Dilicia).

Bottom left: Fisherman with shells of *Pinctada margaritifera* (LINNAEUS, 1758) (Bivalvia / Pteriidae).

Bottom right: *Halotis pustulata* REEVE, 1846 (Gastropoda / Haliotidae).



During the eighties, large Russian trawlers were licensed to fish around Socotra. At present there are reports of local fishermen on an increase of indiscriminate and excessive trawling by larger vessels, which could be highly damaging to spawning and feeding substrates. But at the moment unfortunately neither the island nor the mainland is able to execute the territorial sovereignty of the waters around the Archipelago. With an improved infrastructure, fishing will probably undergo faster a transition from these old, traditional and sustainable ways to new methods, that can be damaging if not applied correctly.

There seems to be a substantial commercial stock of spiny rock lobsters in the coastal waters of the Archipelago, which has been little exploited so far (SAAD 1996) (Fig. 108). The lobsters are usually caught by trapping at night. Abalone are the target of commercial fishery along the south-east coast of Oman, where *Haliotis mariae* GRAY, 1856, with a shell-length of about 10 cm, supports annual catches of around 200 tonnes in shell-weight (SANDER 1982). Abalone are also relatively common in the coastal waters around Socotra, but it is *Haliotis pustulata* REEVE, 1846, with size (length about 4-5 cm) and weight data distinctly lower than those from Oman (Fig. 107). A sea cucumber survey was carried out in 1985, but around Socotra there were no stocks economically worthwhile to exploit. Pearl oysters were fished on a commercial basis around Socotra towards the middle of this century. As a rule, diving was practised by people of African origin, hired for low rates of pay by the owners of the pearling boats (NAUMKIN 1993). The divers clamp their noses with two-pronged pegs, made of sheep- or cow-horn. *Pinctada margaritifera* LINNAEUS, 1758 and *P. radiata* LEACH are still common, but pearling itself is now virtually extinct as an occupation, although recently a number of fishermen have started to collect specimens on a commercial basis. However they sell the whole shells, probably for industrial purpose, to merchants from the Gulf. Despite of this commercially oriented collecting of oysters any harvest of larger ornamental shells by fishermen seems to be relatively rare. There are giant clams (*Tridacna maxima* RÖDING, 1791)), spider conchs (*Lambis truncata sebae* KIENER, 1843) and other attractive species (*Cypraeidae*, *Cymatiidae*, *Cassidae*) in shallow waters even in the vicinity of fishing villages.

No real nesting surveys for marine turtles have been carried out so far; therefore no exact data on the current status are available (Fig. 66). More recently there were only records of nesting of the Loggerhead *Caretta caretta* (LINNAEUS, 1758) near Gubbah; but also the Green turtle *Chelonya mydas* (LINNAEUS, 1758) and the Hawksbill *Eretmochelys imbricata* (LINNAEUS, 1766) are suspected to nest on the extensive sandy beaches, while the Leatherback (*Dermochelys coriacea* VANDELLI, 1761) has been only observed in the waters of the Archipelago.

The capture of turtles as well as the collecting of their eggs seem to be a traditional practice of providing supplementary food for the local people, especially during the summer monsoon season when fishing is difficult, and already FORBES (1903) called the people on Abd al Kuri to be „chelonomphagi“. During this harsh period edible marine invertebrates are collected more intensively along the shore and in shallow water areas.

Fig. 108 Marine biota (next page / nächste Seite):

Top: Ghost crabs live above high water mark along most of the sandy shores. Their eyes are carried on long stalks, giving them an excellent all-round vision. Beside *Ocypoda saratan* (FORSKAL, 1775), which is typical for the coasts of the Arabian Peninsula, also the East African forms *O. ceratophthalma* (PALLAS, 1772) and *O. ryderi* KINGSLEY, 1880 occur on the Archipelago.

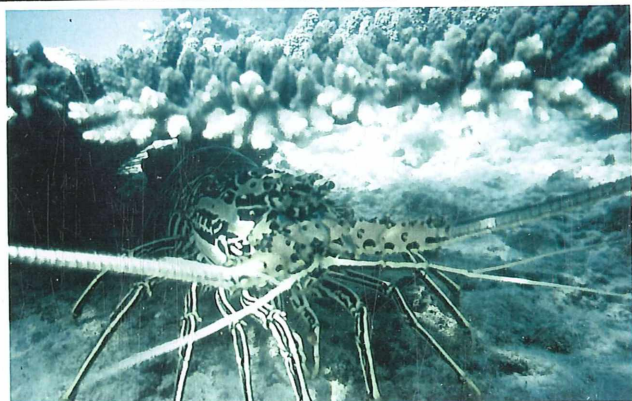
2nd left: *Uca inversa* (HOFFMANN, 1874) (Crustacea / Ocypodidae).

2nd right: *Coenobita* sp. (Decapoda / Paguridae).

3rd left: *Eriphia smithi* MCLEAY (Decapoda / Xanthidae).

3rd right: *Grapsus albolineatus* LAMARCK, 1818 (Decapoda / Grapsidae).

Bottom: *Panulirus* sp. (Decapoda / Palinuridae).



A number of sightings have been reported, but only few specific details are available on the occurrence of *Cetaceans*. The north-western Indian Ocean is a habitat for some twenty species of whales and dolphins, and all of them may occur, at least occasionally, in the waters around Socotra (Fig. 33). Among the large marine animals reported to occur at close quarters are even whale sharks and manta rays in season (CEBALLOS-LASCURAIN 1999).

Dolphins are occasionally caught by fishermen. Their meat is usually used as bait. According to FORBES (1903) the Sperm Whale (*Physeter macrocephalus* LINNAEUS, 1758) must have been a frequent visitor to Socotra waters, judging by the amounts of ambergris which entered trade from the Archipelago throughout historical times. Ambergris is produced in the hindgut of the whale. It is usually associated with the beaks of cuttlefish, which are the whale's principal food. Therefore it may be either an indigestible component of the squid, or a secretion of the gut of the whale in response to the irritation caused by the sharp squid beaks. There is limited evidence for the assumption, that the production of ambergris is pathological in nature. In the gut of the whale it is a black, foul-smelling semiviscous liquid, which quickly oxidizes and hardens to an aromatic greyish waxy and pellucid substance on exposure to sunlight and air. Ambergris is still very popular among the fishermen, but it is found floating on the water or washed ashore, however only very rarely. It can be supposed that also in the past, the substance was mostly taken directly from the intestine of killed or deceased whales.

The people of Socotra

In addition to its unique biological features Socotra is also characterized by a singular traditional culture, which includes the special non-written language Soqotri, and a number of traditional habits and ceremonies. Although not much is known about the early time of immigration, the island has probably been inhabited by humans for about three thousand years. Different waves of immigration seem to have occurred, but the mountain dwellers are considered to be the earliest settlers.

Fig. 109 The people of Socotra (next page / nächste Seite):

Top: Landing of a 'Dash 7' at the airport in Mourì. In summer 1999 commercial air services with jet carriers have started, by use of a new concrete airstrip.

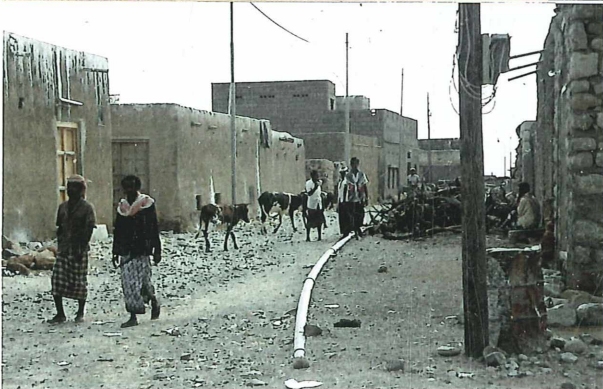
Middle: Arrival of a new Four-wheel-drive. Several thousand Socotrans are believed to live outside the island. They are increasingly sending back cars and building materials. The growth in the number of vehicles used on the island is one of the more visible consequences of „opening“ and a powerful stimulant to additional change.

3rd left: Part of the new sea port near Hawlaf east of Hadibo. The construction was started without any environmental impact assessment.

3rd right: Part of the road from Hadibo to the airport.

Bottom left: The small limewashed houses in Hadibo appear very similar. The streets are covered with a layer of sand and the droppings of many generations of goats. In recent times however they, and the adjacent beaches, are also littered with non- or slow degradable waste materials as tin cans, batteries and, in smaller quantities, plastic. In the foreground, part of the water pipe is visible. Only peri-urban houses in Hadibo use simple covered pit-latrines inside their households. Defecation in the open is commonly practiced.

Bottom right: While pollution and solid waste disposal is not a major problem on the island at present, signs of this problem are starting to manifest inside Hadibo. Polluted area in the surrounding of a Generator in Hadibo.



The total population of the island is not known exactly. Officially estimated at 80 000, the figure is probably much lower in reality. Most people live in the coastal plains, and engage mainly in fishing and trade, while the mountain people of the interior are subsistence farmers and pastoralists. They are semi-nomadic and some of them inhabit caves during several months of the year (Figs. 109-114).

The most important elements of the local economy are the production of livestock and coastal fishery. A number of families practise subsistence farming with small-scale production of fruits and vegetables for local consumption, but the harsh climate restricts such cultivation to certain areas. Furthermore there are handicrafts in the form of carpet weaving, basket making and pottery. Traditional activities carried out by the local population include storage of fish either by salt or by boiling, harvesting and storage of dates in animal leather, collection of honey from beehives available in the mountains, manufacturing and dying of wool for tablecloths and bedcovers. Especially the mountain dwellers have a thorough knowledge of the flora, and many plants have traditional uses, such as providing livestock fodder, fuel, building materials, foods, gums, or resins. Plant extracts are also used in medicines, cosmetic and hygiene preparations, as well as a source of insecticide and in tanning and dyeing.

Nevertheless, in economic development Socotra has lagged seriously behind the mainland of Yemen. At present there is only a provisional road system, which consists of a series of bulldozed tracks, and electricity is available only for a few hours a day in the main coastal settlements. Medical services are very basic. The only hospital in Hadibo is still poor in facilities and services. Predominant health problems include malaria, respiratory diseases, especially tuberculosis, intestinal illness, malnutrition and birth-associated disorders. Rural water supply mainly consists of open hand-dug wells and some centrifugal pumps. Only around Hadibo and in the Wadi Ayhaft water supply exists with the help of water cisterns in the mountains and an extended pipe system. Because of the lack of any special filtration and water quality control a permanent potential danger of water-borne diseases exists. Side effects of this more comfortable water supply are an increased quantity of waste water, and the support of mosquito breeding in water ponds formed by the leakage from pipelines. Rural sanitation does not exist, and defecation in the open is commonly practised. Solid waste, which mostly consists of metal cans and plastic with reduced amounts of organic materials, is usually discharged unhesitatingly into the environment. Organic parts are eaten by vultures and goats, and probably thanks to them the waste dumps are not infested with rats. Even more extreme and more basic is the situation for the people living on Samha and Abd al Kuri.

Despite or because of these comparatively poor living conditions principles of co-operation, self-help and community labour are well established, and there is also a whole range of relevant traditional rules and practice which are of ecological importance. These „unwritten laws“ include regulations which control the cutting of live wood, forbid the use of other than dead wood as firewood, regulate grazing and the cutting of vegetation as fodder and preserve important fruit bearing trees. Traditionally the local people practise rotational grazing, and the practice of transplanting and sowing certain plants and protecting them from livestock while they grow has been known and applied for a long time. All important problems are discussed and decided during meetings of local councils.

The opening of the island has stimulated plans to improve the living conditions and infrastructure, such as Socotra Sea Port, Socotra Airport, Roads Development, Socotra Electricity and Water Supply, Medical Care and Education. In the meanwhile two of these „key“ projects - the improvement of the airfield and the construction of a sea port near to Hadibo - have already been realized to a large extent, but without an environmental impact assessment. Both will lead to an increasing influx of goods and technical facilities. The growth in the number of 4-wheel drive vehicles during the last years is already a visible consequence, and a powerful stimulant to further development. Also on Socotra the motor vehicle will become one of the most potent symbols of social and economic change. As a consequence there will be not only more excessive vehicle use on a widening network of tracks, but vehicles will carry also an increasing range and quantity of goods, water, purchased feed and weighty building materials from the larger settlements to the surroundings and back. Great risks will also result from an indiscriminate import and use of chemicals, such as fertilisers, pesticides or detergents.

But not less important are social aspects. As a result of economic development the traditional activities will change, the traditional life style will become less attractive and the dependence of the people on local resources will greatly diminish.

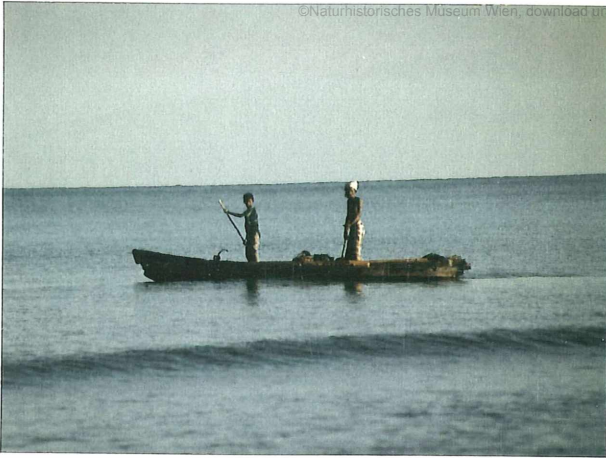


Fig. 110 The people of Socotra (previous page / vorige Seite):**Top:** Traditional forms of fishing.**Middle left:** Fishermen in Hadibo.**Middle right:** Fishermen with shark.**Bottom left:** Salted fish.**Bottom right:** Fishermen in the market in Hadibo.

This may have the consequence that their knowledge and their understanding of the value of these resources will also diminish with a consequent lessening of interest in using them with traditional skill and wisdom. Exchange of goods and services between coastal and mountain people is common and forms a bond that links the different parts of the island. But also these traditional exchanges will become less important than they were because more and more local goods will be replaced by imports.

The traditional patterns of work may also alter by an increase in labour migration and remittance money. Accumulation of possessions usually leads to greater individualism in many spheres of life, resulting in the abandonment of the self-imposed restraints on the exploitation of natural resources. People think in terms of the short-term advantages to be gained from an immediate exploitation of available resources. In this connection also the ownership of land, up to now settled by traditional agreements, will become another dimension. It can not be foreseen how far the economic changes will affect the existing forms of living together, and how far it will be possible to control the negative effects of „individualism“ whilst encouraging the positive aspects of private enterprise. A first idea of possible conflict in the future is given by the situation in the vicinity of the larger coastal settlements, such as Hadibo and Qalansiyah, where life has already become more commercially oriented. Even if there are no great changes visible yet, it seems that wood gathering occurs more systematically with the increased demand of timber for better housing. There are also localized grazing impacts and first signs of a waste problem induced by an increased discharge of raw sewage and litter.

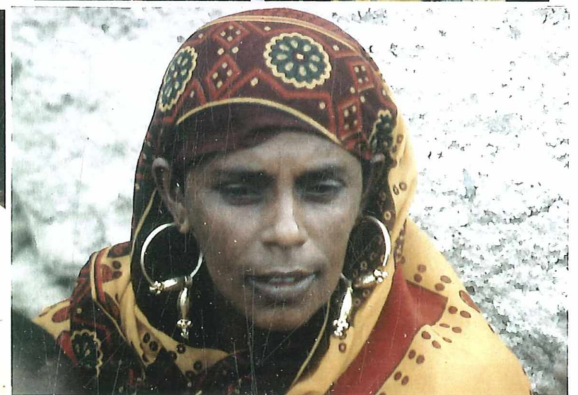
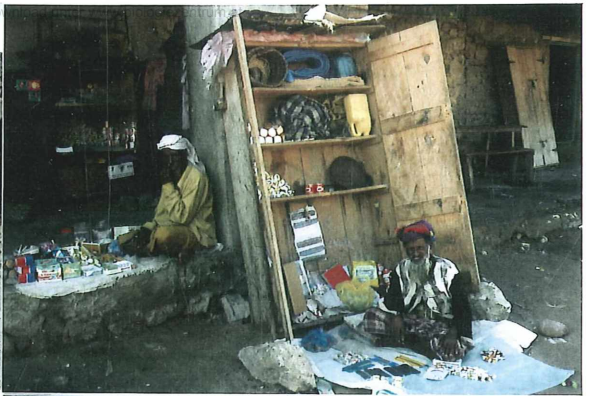
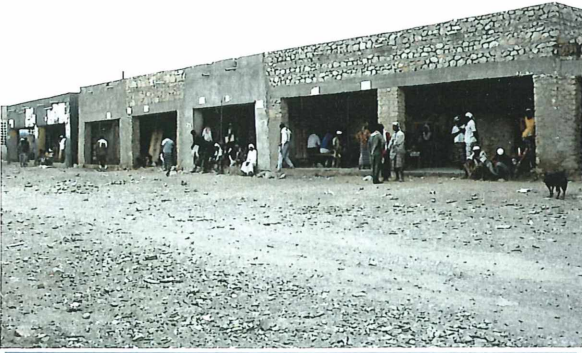
Rumours are also numerous about plans for turning the island into a „free zone“ area, a diving paradise, a casino haven for wealthy Arabs, a U.S. military air and naval base or assigning mining rights.

These are only a few examples of the great number of different natural factors and socio-economic processes which are linked in a complex and net-like manner, making the process of development and any prediction for the future difficult. Undoubtedly the Millennium marks a crucial turning point for the Archipelago, which represents a fragile ecosystem. Any inappropriate development might also have unwanted side effects that could damage the delicate ecological balance of the islands, risking much more than the survival of many of the endemic species.

Fig. 111 The people of Socotra (next page / nächste Seite):**Top:** View to the main street in Hadibo, and a trader with a cupboard store.**2nd left:** Hadibo, view to the mosque.

2nd right: School in Hadibo. On Socotra there are about 25 schools, but there are great differences between those located on the coastal villages and others servicing remote mountain areas. The overall percentage of illiteracy is estimated to be 60-70 %.

3rd left: Women making baskets.**Middle right:** Musicians in Hadibo.**Bottom left:** Making of local Pots decorated with Dragon's blood.**Bottom right:** Women, coastal area.



Prior to unification there was neither specific wildlife conservation nor protected areas legislation in either of the two parts of Yemen. Nowadays the responsibility for wildlife conservation in the Republic of Yemen lies with the Ministry of Agriculture and with the Environmental Protection Council (EPC), and both have taken a variety of measures to set up a frame for wildlife laws and a site protection system, as well as environmental education activities. Yemen has also ratified the Convention on Biodiversity in 1996. Nevertheless, the ecological data base in the country is still relatively poor and there are also problems with control regulations.

For a number of years the Socotra Archipelago has been identified by IUCN, UNESCO and other international organisations as a very high priority area with a proposal to be nominated for recognition under the Man and Biosphere Programme. And in the National Environment Action Plan of the country of Yemen the establishment of National Protected Area on Socotra was identified as one of the priority actions, which was subsequently incorporated into the Yemen First Five Year Plan (1996-2000). A High Committee for Development of Socotra has been operating since January 1996. This multidisciplinary body has the task to prepare a Master Plan for Development of the Archipelago in co-operation with the UNDP, GEF and EU initiatives, which will integrate biodiversity conservation, environmental management and development objectives.

But in spite of existing recommendations for critical areas and concepts of protection, such as the report of the UNESCO Fact Finding Mission 1993 (EUROCONSULT 1994) or the proposals of Nature Reserves and a number of Sites of Special Scientific Interest as an outcome of the 1999 Multidisciplinary Expedition, many details of the most effective strategy of development and conservation are still unclear. A simple establishment and maintenance of large protected areas could cause not only problems of acceptance among the local people, but would also not be sufficient as a concept for sustainable development. Any successful strategy for the conservation of the islands nature will have to build on the traditional rules and regulations which already exist. This will ensure the acceptability of the local population for an integrated development programme and a nature conservation programme, and allow them to combine local money-earning activities with their traditional way of life. Therefore as part of a protection strategy, potential revenue sources for the local population must be developed with their active participation and involvement, and for their benefit. These could include small-scale tourism, the cultivation of native plants, or the collection and storage of seeds and cuttings for propagation.

Island ecosystems are fragile, and island biota are among the most vulnerable of all biota to changing environmental conditions. This is also true for the Socotra archipelago. Although large parts of the islands appear at present to be protected by their inaccessibility, any development should be subject to some form of environmental impact assessment to determine the possible effects on the whole ecosystem. Since the level of botanical knowledge of the Archipelago is more advanced than that of the zoological taxa, the present selection of terrestrial core zones is mainly based on the mapping of vegetation. More studies are needed to determine also the most sensitive or critical habitats for animals, and to fill the numerous gaps in knowledge of the fauna, such as the population size of species, their distribution and their basic ecological needs in order to implement special and effective conservation strategies.

Fig. 112 The people of Socotra (next page / nächste Seite):

Top & middle left: Gathering of dates. Date palms grow along the banks of the streams, near the shore and at other suitable places.

Top right: House in Hadibo.

2nd right: Storage of dates in the skin of goats.

3rd right & bottom right: Garden in Hadibo. Cultivation is still on a small scale.

Bottom left: Simple stony structure used for livestock and storage of goods.

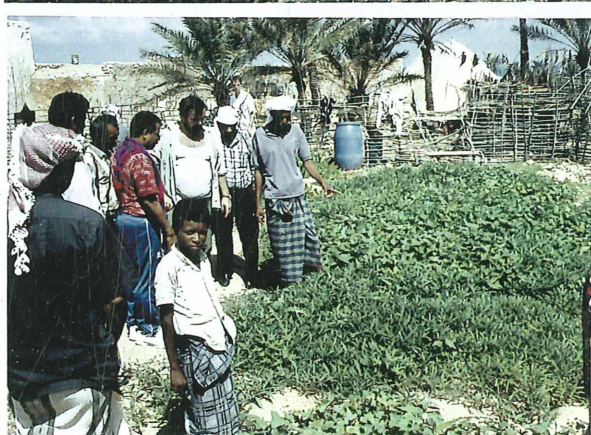
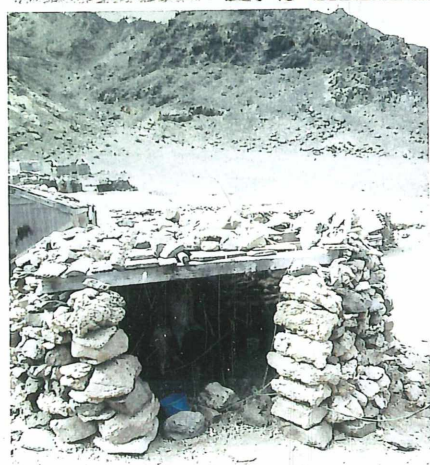
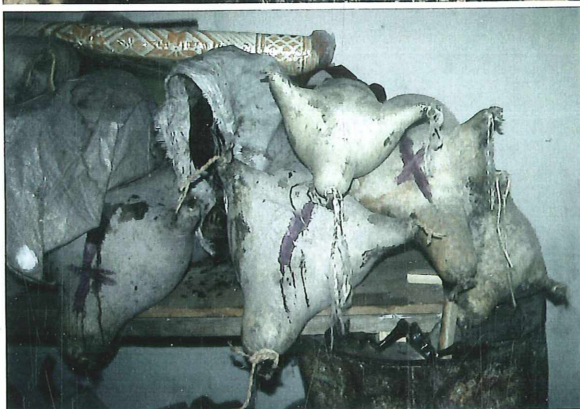
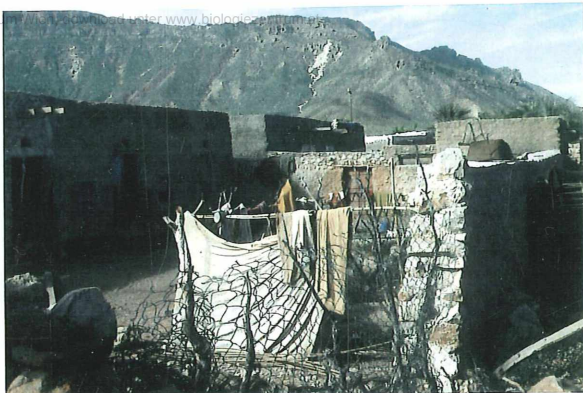
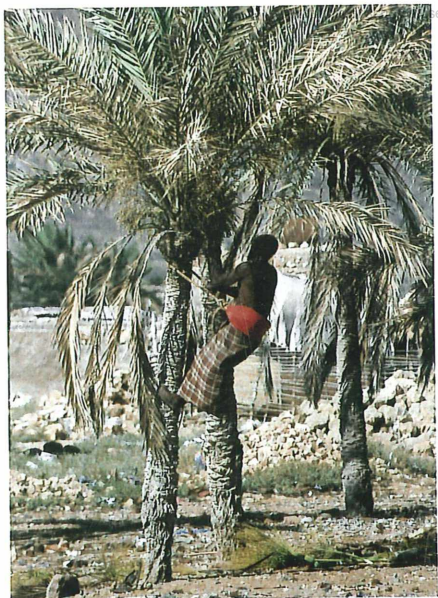


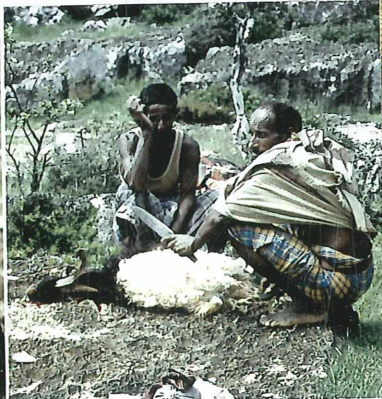
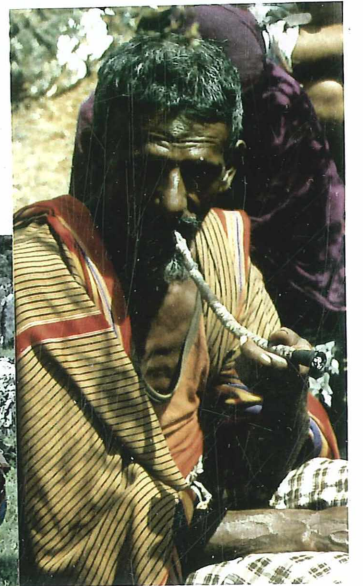
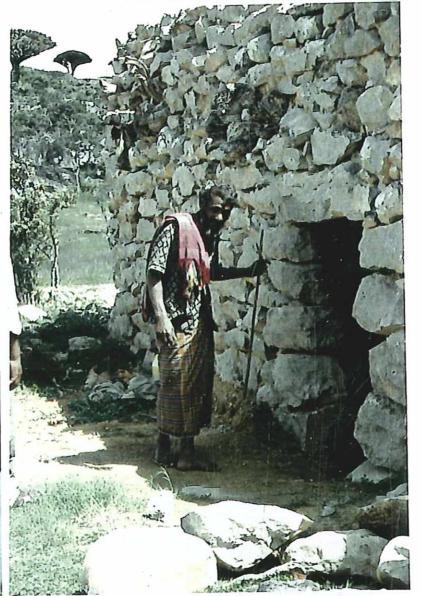
Fig. 113 The people of Socotra (next page / nächste Seite):

Top left: Residence in the mountains.

Top right: Rubbing noses is the traditional form of welcome in the mountains.

2nd & 3rd left: Deiyyub, with enormous stalactites and stalagmites, is perhaps the most impressive cave on the island. It is located in the escarpment overlooking the southern Noged plain.

Middle right & bottom: Mountain dweller. They walk barefooted on the razor-edged stones without difficulty, and in the field they often appear from nowhere.



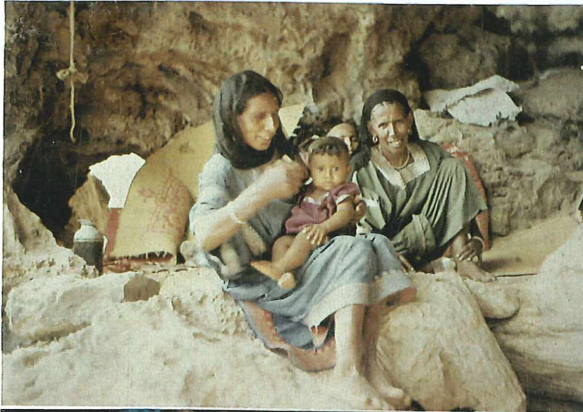
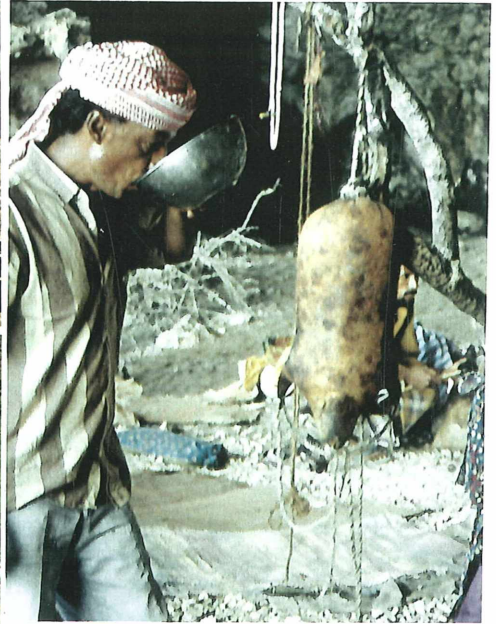


Fig. 114 The people of Socotra (previous page / vorige Seite):

Top left: Children in the mountains collecting wood (Diksam). Wood is in high demand for heating, cooking and building purposes and also as fuel for the manufacture of lime. Provision of alternative sources of energy, such as natural gas, is therefore an important factor in nature protection.

Top right: View into a cave which is used by mountain people. Milk is of great importance for their life, it is used in different forms. A milk-skin for the production of butter can be seen on the photo.

2nd left: School in the mountains.

Middle right & below right: Home made toys.

3rd left: Women with child in a cave in the mountains.

Bottom left: Traditional way of making fire.

At the moment it is difficult to say how far animal species are already endangered. Some species seem to be restricted to certain areas on the island, and to exist in relatively tiny populations, which makes them vulnerable.

But the flora and fauna of the Archipelago are not only endangered by habitat destruction. More trade usually leads to an introduction of alien species, and newly introduced species, animals and plants, can upset natural ecological balances permanently, sometimes resulting in mass extinction.

The islands of the archipelago have a special meaning for collectors of succulent plants and other commercially attractive organisms. Already, a number of endemic succulent plant species are offered in catalogues on the international market, and commercial interest has also been expressed by pharmaceutical trusts on some plant extracts of medical importance.

Socotra is a very special part of Yemen's heritage, and it provides both an opportunity and a challenge for mankind. Fortunately the concept and value of conservation is still high on the agenda of the islanders, and therefore it is to be hoped that local, national and international efforts to protect Socotra's unique wildlife are successful, and that the Archipelago's uniqueness is maintained for the benefit and pleasure of future generations.

Acknowledgements

At this point I would like to express my gratitude to all those Yemenite colleagues and institutions who helped me during my work in the country by taking part in activities in the field.

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Tables 1-3 are found on the pages 267-271.

Die Tabellen 1-3 sind auf den Seiten 267-271 abgedruckt.

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Addenda & Errata

page 119: BOTTING's (1958) assumption does not correspond to the known tectonic data.

page 121: 14 species of mammals, record of *Rhinolophus clivosus* CRETZSCHMAR in 1999.

page 121: About 180 bird species, 40 breed, 80 regularly occur on migration or in winter and about 60 are vagrants (Porter, pers. inform.); *Cisticola haesitata*, *Incana incana*.

page 125 - fig. 35: read "previous page" only.

page 127 - fig. 37: There are indications, but no confirmation, to the occurrence of a second owl beside the African Scops Owl (*Scops senegalensis*); the estimations of the Aden population size of *Corvus splendens* were between 50 000 to 2 million specimens (ASH 1984); the shrike on Socotra is the Southern Grey Shrike (*Lanius meridionalis*)

page 133: If there was a „giant lizard“ on Socotra, it was more probably a huge skink or gecko than a monitor, because of the known biogeographic history of varanids (BÖHME et al. 1989); in one case (Moini area) people told us that they use the fat of the chameleon as a remedy against skin diseases; examination of fossil skulls from the Seychelles revealed the species to be the salt water crocodile (King, pers. inform.).

page 136: In response to conspecifics and observers the semaphore geckoes (*P. sokotranus*, *P. abdalkuri*, *P. samhaensis*) performed the following signals, usually in the same order and each motion repeated on the average three to four times

- raising of the whole body as far from the ground as possible
- the tail is slightly curved, raised upwards, held stiff and moved up and down
- the tail is moved back to the ground and wagged from side to side.

page 138: There were no distinct morphological differences between the *Pristurus* recorded from Samha and Darsa.

page 143: At the end of the text block read "to be continued on page 166 / wird fortgesetzt auf Seite 166"

page 158, 166: *Mesalina* and *Mabuya* occur on all the four islands. It needs further studies to clarify their status of speciation, however there seems to be a distinct difference between the *Mesalina* population on Abd al Kuri and those from the other islands.

page 164, 166: The most easy explanation of the obvious contradiction with the type specimen of *C. monachus* is a label error. However, even if unlikely, it can not be excluded, that a living specimen from Socotra arrived at Madagascar by a trader or sailor.

page 168: Specimens of *Coluber sokotrae* recorded from Samha and Darsa were blackish without or with an indistinct marking. However, beside the colour we did not find any distinct morphological differences in size and pholidosis; *Echis coloratus* GÜNTHER, 1878.

page 192: *Teddia* mantids have been recorded from Socotra, Samha and Darsa.

page 196: Records of *Lophyrina aulica* (DEJEAN, 1831) (Cicindelidae) in swamp areas of Socotra and *Caminara chlorostictum* in Hadibo and in the mountains in spring 2000.

page 208: Chrysopidae recorded at the light, larvae of Neuropteridae in a cave (Socotra).

page 225, 228: *Hemiscorpius* recorded from Darsa (light in colour as the form from Samha).

page 227, 232: The occurrence of *Latrodectus tredecimguttatus* (see FORBES 1903) is doubtful, we recorded *L. geometricus* C.L.KOCH and *L. hystrix* SIMON (v. Hartem, pers. inf.).

page 228: There is at least a third species of freshwater crab, which is similar in appearance to *P. sokotrensis*. It lives in a waterfall area in the western part of the Noked plain.

page 240, 244: Operculate forms may close their shell quite well to prevent dehydration. They are more common in the plain areas. Pulmonates close their aperture with a mucus shield, bury in the ground or use crevices to overcome dry periods; *Riebeckia sokotrana*.

Table 1/2: An update of the tables has caused some differences to the data in the text.

Tab.1 Taxonomic compilation of terrestrial and freshwater fauna Socotra Archipelago (Vertebrates):

taxonomic classification	species recorded	endemic (tentative)	main references	remarks
MAMMALIA	14	0		
Insectivora	1		DOE 1992	first record of a living shrew in 1999 (JAGER), status uncertain
Chiroptera	3		FORBES 1903; WRANIK et al. 1991; DOE 1992	records of <i>Rhinopoma hardwickei</i> also from Samha and Abd al Kuri
Carnivora	2		FORBES 1903	including domestic cat
Rodentia	2		FORBES 1903	
Artiodactyla	5		FORBES 1903	livestock
AVES total	180	6	SCLATER & HARTLAUB 1881; HARTLAUB 1881; FORBES 1903; RIPLEY & BOND 1966; PORTER & STONE 1996	11 endemic subspecies need further taxonomic studies to clarify their status
breeding birds	40	6	PORTER & STONE 1996	
REPTILIA	27	24	BLANFORD 1881; GÜNTHER 1881; PETERS 1882; BOULENGER 1903; STEINDACHNER 1903	existence of larger species (crocodiles, giant lizards, land tortoises) in the past uncertain
Sauria	22	19	ARNOLD 1986; SHOWLER 1996; RÖSLER & WRANIK 1998; WRANIK 1998	Abd al Kuri: <i>H. forbesii</i> , <i>H. oxyrhinus</i> , <i>P. abdelkuri</i> (also on Socotra), <i>Mabuya socotranus</i> , <i>Mesalina balfourii</i> ; Samha: <i>Pristurus samhaensis</i> , <i>Hemidactylus homeolepis</i> , <i>Haemodracon</i> aff. <i>riebeckii</i> , <i>Mesalina balfouri</i> , <i>Mabuya socotranus</i> ; Darsa: <i>Pristurus samhaensis</i> , <i>Mesalina balfouri</i> , <i>Mabuya socotranus</i>
Serpentes	5	5	PARKER 1949; CORKILL & COCHRANE 1965	the record of <i>Echis coloratus</i> by BALFOUR (1880) is considered as a locality error Samha & Darsa: <i>Coluber socotrae</i>
AMPHIBIA	0			no traces so far
PISCES (freshwater)	1		Health Department Aden (personal information)	introduction of <i>Aphanius dispar</i> within an anti-malaria campaign

Tab. 2 Taxonomic compilation of terrestrial and freshwater fauna Socotra Archipelago
(Invertebrates):

taxonomic classification	species number ¹	endemic (tentative)	main references	remarks
MOLLUSCA	62		MARTENS 1883; CROSSE 1884; SMITH 1903	
Gastropoda (land)	56	about 80 % ²	GODWIN-AUSTEN 1881; SALVAT 1969	endemism probably 100 %
Gastropoda (freshwater)	6		GODWIN-AUSTEN 1883	no traces of freshwater bivalves so far
ARACHNIDA	43		POCOCK 1899 & 1903	
Scorpiones	5	3	TASCHENBERG 1883; POCOCK 1899 & 1903;	
Solifugae	1	1	POCOCK 1903	
Palpigradi	1	?		recorded
Araneae	30	?	POCOCK 1899 & 1903	
Opiliones	1	1	POCOCK 1903	
Acari	5		TASCHENBERG 1883; POCOCK 1903;	
CRUSTACEA	6	5	POCOCK et al. 1903	
Decapoda	4	3	TASCHENBERG 1883; POCOCK et al. 1903	one land and three freshwater crabs
Isopoda (land)	2	2	FERRARA & TAITI 1996	about 30 species are under description (TAITI)
Entomostraca			(Cladocera, Ostracoda, Copepoda, Anostraca)	recorded
CHILOPODA	7	2	POCOCK 1899 & 1903; LEWIS & WRANIK 1990	Scutigeridae recorded
DIPLOPODA	4	3	POCOCK 1903	Siphonophora recorded
INSECTA	588		TASCHENBERG 1883; FORBES 1903	
Apterygota			(Thysanura, Collembola, Diplura)	recorded
Odonata	20	1	FORBES 1903; KIMMINS 1960; SCHNEIDER 1996	
Saltatoria	54	about 63 % ²	BURR 1898 & 1903; KRAUSS 1907; UVAROV & POPOV 1957	
Dermaptera	3	2	BURR 1898 & 1903; KRAUSS 1907	
Blattaria	3	1	BURR 1899 & 1903; KRAUSS 1907	
Mantodea	3	2	BURR 1903; KRAUSS 1907; KALTENBACH 1982	
Isoptera	2	2	FORBES 1903; HARRIS 1954	
Heteroptera	35		KIRKALDY 1903; LINNAVUORI 1994	
Embioptera	2			
Homoptera	6	5	KIRKALDY 1903; DOE 1992	
Coleoptera	106	about 35 % ^{2,3}	WATERHOUSE 1881, GAHAN 1903	
Tenebrionidae	31		KOCH 1970	
Hymenoptera	74	about 66 % ²	KIRBY 1903; KOHL 1907; EMPEY 1973; SOIKA 1974	
Formicidae	13	0	COLLINGWOOD & AGOSTI 1996	
Neuroptera	12	8	KIRBY 1903; KIMMINS 1960; TJEDER 1974	
Strepsiptera				recorded (POHL)
Diptera	75	?	RICARDO & THEOBALD 1903; BECKER 1931	
Nematocera	11	1	LEESON & THEODOR 1948; MATTINGLY & KNIGHT 1956	
Bombyliidae	16-17	9	GREATHEAD 1969	
Trichoptera	2		DOE 1992	
Lepidoptera	191	61	OGILVIE-GRANT, HAMPSON, WALSINGHAM 1903; REBE 1931	

¹ the numbers are summarized from literature and can serve for the most groups as a certain orientation only

² after KOCH 1970 ³ Coleoptera without Tenebrionidae

Tab. 3 Native animal names of Socotra

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type of animal	scientific name	name in Soqotri
Mammals		
cattle (adult cow / adult bull)		ilheh / fa'hər
donkey (adult male)		hamar
dromedary (adult male)		bə'ér
sheep (adult female)		té / pl.: tētīn
goat (adult female)		'uz / pl.: irəhān
black rat / mouse	<i>Rattus rattus</i> / <i>Mus musculus</i>	zá'dihim / pl.: zá'dihum
bat	no difference between species	géleməno / pl.: gélhəmənitən
civet cat	<i>Viverricula malaccensis</i>	zibādiyāh / pl.: zibidəhen
house cat		gírbaḵ / pl.: gərəbəḵ
„wild cat“	probably feral house cats	haşoşe
dolphin		'iləhe / 'il'hə / pl.: 'il'hóytin
whale		šihātə
Birds		
heron	Ardeidae	nəghór
gull	Laridae	mişeriyeh
vulture	<i>Neophron percnopterus</i>	sō'ideh
birds of prey		qeshfəno
owl	<i>Otus senegalensis</i>	šigidəhān / pl.: šigidəhon
pigeon		West: kú'ku' / qyōḵoh East: dgū'gū / pl.: il gāghitən
Great Grey Shrike	<i>Lanius excubitor</i>	sarhānqiyeh
raven	<i>Corvus ruficollis</i>	é'erib / 'á'rib
starling	<i>Onychogn. blythii</i> / <i>O. frater</i>	šilihe
sparrow & other small birds	<i>Passer insularis</i>	işfəroh / pl.: 'işfər
yellow coloured small birds		dī kirəkem
small bird	<i>Eremopterix</i> ?	dī kōfiyah
Reptiles		
small gecko	<i>Pristurus</i> sp.	nūwno / nōnu
large gecko	<i>H. riebeckii</i> / larger forms of <i>Hemidactylus</i>	rəho / pl.: raḥiyītin
gecko with sticky feet	smaller <i>Hemidactylus</i>	liska / pl.: lísak
skink	both species	gimsh / gāmš / pl.: egāmēšo
lizard	<i>Mesalina</i>	dī ḥilub
chameleon	<i>Chamaeleo monachus</i>	meşhēbihi / pl.: meşhēbəho
worm like snakes	<i>Typhlops</i> / <i>Leptotyphlops</i> / <i>Pachycalamus</i>	dī hōyhi
colubrid snakes	both species a further specification is in dependence of coloration	general: bəkīli / pl.: bēkəl <i>Ditypophis</i> - bəkīli dəməno <i>Coluber</i> - bəkīli əwri'uh bəkīli d ḥāziyuk / pl.: bəkīl il ḥāziyuk bəkīli 'ābdəher / pl.: bəkīl il 'ābōdihir
marine turtles		female: ḥómis male: 'ébəhān / pl.: 'ébihun
Fishes		
fish		general: sōda
mudskipper		ḥafiz

Insects		
small insects		kubîbîhin
small water living forms		ķidēhən /pl.: ķadōhən
dragonfly		ʾidbəhir d rēho
mantid		baher dimelik
grasshopper	larval stages	hārzeb
small grasshopper or locust		ʾirbehîyo /pl.: ʾîrbəhi
pale coloured „cricket“	<i>Glomeremus</i> sp.	di kākā d irəhān
crickets	Gryllidae	di kākā tētin
large grasshoppers	<i>Pachysmopoda abbreviata</i>	sij'ara
termite		židîrə
termite mound		gidərə d ižidîrə
biting insects, but also anything that bites		ķesérə / ķesá'her
flea		dérher
nits		nîb /pl.: nōb
young lice		gerə'áno
adult lice		kōnim /pl.: kən'hum
bed bug		girihi
bug		infē'iš
cicada		rāķi'hin /pl.: rāķá'ihun zigārə / zadihēr
water beetle		hanšuîlə
dung beetle		mižōbihin di 'ub pl.: mižōbihin il 'ub
ground living beetles		hanṭîyo / eghēr
beetle	Buprestidae	opra
beetle	large Elateridae ?	na'fā'kahin
types of caterpillar		kîrél tāba'aš ta'ālə d qéša'a
nocturnal insects	moth / ant lion	šēr'hin
butterfly		šamšēhāni
worm, grub, maggot		ta'ālə / pl.: tāhal
bee- or wasps	various Hymenoptera	general: ʾidbəhir / pl.: ʾidbəhor
honey bee	<i>Apis mellifera</i>	ʾidbəhir di 'asel
wasp	<i>Belenogaster</i>	ʾidbəhir di zingélo pl.: ʾidbəhur il zingélo
ant		general: nimihil / pl.: niməhol general: díftim / pl.: díftom black biting ant - méksər díftim / díftim red biting ant - nimihil 'āfər black ant - nimihil hāhər large <i>Camponotus</i> - qazér
flies on rotten material	Calliphoridae	di 'érhən
bot-fly	<i>Oestrus ovis</i>	di 'āser / pl.: il 'āser
small flies that attack cattle		hāšim
tiny biting fly or midge		bēkek / pl.: bukkāk
larger flies	<i>Asilidae</i> ?	idibbeh / pl.: idbib
mosquito		ķerîš /pl.: ķerāš
mosquito larvae		'āmərəž /pl.: 'āməruž

Myriapods		
large centipede	<i>Scolopendra</i> sp.	di ḥaṣāḥən / <i>pl.</i> : il ḥaṣāḥən
smaller centipede or millipede		ta'ā no
Arachnids		
scorpions		<i>general</i> : di ká'ṇəḥən / <i>pl.</i> : il ká'ṇinhən <i>black specimens</i> : di ká'ṇəḥən ḥəkər
Palpigradi		di áber
web spinning spider		<i>general</i> : šəkīyə
tarantula	<i>Monocentropus balfouri</i>	fiṭāmə / <i>pl.</i> : fiṭəḥəm
reddish tick or spider		lá'abhən / <i>pl.</i> : lá'abihun
tick		<i>normal size</i> : šerb / <i>pl.</i> : isrēbo <i>swollen ticks after blood sucking</i> : kháməlo 'ébhān
small sucking organisms		šerib
tick, appears after rains, found around horns and mouth		d šif'o d tīyo
Crustaceans		
crab	land, marine and fresh water crabs	<i>general</i> : ḥənsī'o
larger fresh water crab	<i>Socotra pseudocardiosoma</i>	ka'chebeb
woodlouse		<i>West</i> : táršiš / <i>pl.</i> : tárʌšiš d gérmiš
Mollusks		
general for snails		<i>West</i> : ḥángəs / <i>pl.</i> : ḥángós
large shells	<i>Otopoma, Riebeckia</i>	filāmə / <i>pl.</i> : filiḥem
pointed large shell	<i>Riebeckia</i>	<i>East</i> : šá'əḥər d fižānə
pointed small tree snails	<i>Achatinelloides</i>	šá'əḥər / <i>East</i> : šōḥəṣiḥ
squid	Octopus	ʿátərhe
Echinoderms		
sea urchin		ú'eri' / é'eri'i / <i>pl.</i> : 'éra'han

¹ This list is based on discussions with local people, especially with Saed Al Kadoumi, the medical doctor on Socotra. Included are also information from the Scottish Scientist Miranda Morris, who is one of the few foreigners speaking the local language Soqotri. A number of names is still vague, need verification and also a clarification of the exact type of organism.

Font interpretation (after MORRIS, pers. Information)

ā (aa, long vowel)

ē (ee, long vowel)

ō (oo, long vowel)

ʾ (hamza or glottal stop)

ʿ (arabic ʿayn)

ə (short vowel as first e in before)

ī (ii, long vowel)

ṭ (emphatic t)

š (sh)

ṣ (emphatic s)

ḍ (emphatic d)

ū (uu, long vowel)

ḥ (emphatic h)

ž (soft j as French je)

ẓ (lateral z, voiced)

ṣ̌ (lateral s, unvoiced)

ẓ̣ (emphatic lateral z, voiced)

ṭ̣ (th)

ˈ above a vowel denotes stress, which is very important in Soqotri